Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

February, 1935

Volume 109 *No. 2*

Published on the 26th day of the month preceding the date of issue by the

Simmons-Boardman Publishing Company

1309 Noble St., Philadelphia, Pa. Editorial and Executive Offices,
30 Church Street, New York, N. Y., and 105 West Adams Street, Chicago, Ill.

Cleveland: Terminal Tower
Washington: 832 National Press Bldg.
San Francisco: 55 New Montgomery St.

Subscriptions, including 12 regular monthly issues, payable in advance and postage free. United States and possessions: 1 year, $3; 2 years, $5. Canada, including duty: 1 year, $3.50; 2 years, $6. Foreign countries: 1 year, $4; 2 years, $7.

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service.

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Equipment Orders in 1934 Show Large Increases

Purchases largest since 1930—Orders for domestic service total 72 steam, 76 electric and 34 internal-combustion locomotives; 24,611 freight, and 388 passenger-train cars

IN 1934 a larger number of rail motive power units and rolling stock of all types were purchased than the records have shown for several years. The last year in which such purchases were of any appreciable size was 1930. In that year orders for locomotives and cars, while by no means equal to those in 1929 and the years immediately preceding, were yet far greater than in the extremely lean years 1931, 1932 and 1933. In 1930 domestic orders totaled 440 locomotives, 46,360 freight cars, 667 passenger cars and 65 rail motor cars.

Locomotive Orders

In 1934 a total of 88 steam locomotives were ordered. Of these 68 were for domestic railroads, four for industrial companies, 16 for export and none for service in Canada. The largest single order was that of the Delaware, Lackawanna & Western for 20 of the 4-8-4 type. The Lehigh Valley ordered five of the same type, while the Nickel Plate ordered 15 of the 2-8-4 type. Single-expansion articulated locomotives of the 2-6-6-4 type were ordered by two roads—three for the Pittsburgh & West Virginia and five for the Seaboard Air Line. Orders from foreign countries were received from Chile, Venezuela, Columbia, Mexico and China.

The Pennsylvania ordered 58 electric locomotives with a 2 — C + C — 2 wheel arrangement for heavy passenger service between New York, Philadelphia, Baltimore and Washington. These locomotives are streamlined, designed for an operating speed of 90 m.p.h., have 57-in. driving wheels, weigh 460,000 lb., and develop 4,620 hp. at high speeds. The same road also ordered one locomotive with a 2—D—2 wheel arrangement and 14 switching locomotives with three pairs of driving wheels. The only other electric locomotives ordered were three by the Chesapeake & Ohio for special pusher service at a new car-dumping coal dock, Presque Isle (Toledo), Ohio.

As regards locomotives driven by internal-combustion engines a total of 35 were ordered during the year. Twenty-eight of these locomotives were ordered by 14 different railroads, including 11 for the Illinois Central and four for the Delaware, Lackawanna & Western. Of the remaining seven locomotives six were for four in-

Table I—Orders for Locomotives of All Types Since 1915

Year	Domestic	Canadian	U. S. Export	Total
1915	1,612	...	850	2,462
1916	2,910	...	2,983	5,893
1917	2,704	...	3,438	6,142
1918	2,593	209	2,086	4,888
1919	214	58	898	1,170
1920	1,998	189	718	2,905
1921	239	35	546	820
1922	2,600	68	131	2,799
1923	1,944	82	116	2,142
1924	1,413	71	142	1,626
1925	1,055	10	209	1,274
1926	1,301	61	180	1,542
1927	734	58	54	846
1928	603	98	27	728
1929	1,212	77	106	1,395
1930	440	95	20	555
1931	176	2	28	206
1932	12	1 (Export)	1	14
1933	42	...	7	49
1934	182	...	17	199

Table II—Types and Number of Steam Locomotives Ordered in 1934

Type	Railroad service	Industrial service	Export	Tota
0-4-0	..	1	..	1
0-8-0	6	..	..	6
2-6-2	..	1	2	3
2-8-0	1	..	..	1
2-8-2	1	..	10	11
2-8-4	15	..	..	15
2-6-6-2	..	..	2	2
2-6-6-4	8	..	..	8
2-8-8-2	..	..	1	1
4-4-2	2	..	..	2
4-6-2	5	..	..	5
4-8-2	5	..	..	5
4-8-4	25	..	..	25
Misc.	..	2	1	3
Total	68	4	16	88

dustrial companies and one for export. Two of those listed as industrials were for demonstration purposes. One of these was of 3,600 hp. capacity. Only three of the engines used gasoline as fuel and all but two were provided with electrical transmission.

A point on which particular attention was focused in 1934 was that of speed. While Diesel-electric articulated light-weight streamline trains with their spectacular runs were in a large measure responsible for this aroused interest, the steam locomotive continued to demonstrate its ability to do remarkably fast running if this is desired. The Chicago & North Western has rebuilt four Pacific type locomotives, increasing the size of the drivers to 79 in. and raising the steam pressure. These locomotives are operating five-car trains of standard equipment on a 408½-mile run between Chicago and the Twin Cities in 420 min., an average speed of 58.35 m.p.h. This is the world's fastest train scheduled for such a distance. The Chicago, Milwaukee, St. Paul & Pacific will soon have in operation two new streamline locomotives of the 4-4-2 type. In the east the New York Central has fully streamlined one of their Hudson type locomotives.

Table III—Orders for Freight Cars Since 1915

Year	Domestic	Canadian	Export	Total
1915	109,792	......	18,222	128,014
1916	170,054	......	35,314	205,368
1917	79,367	......	53,191	132,558
1918	114,113	9,657	53,547	177,317
1919	22,062	3,837	3,994	29,893
1920	84,207	12,406	9,056	105,669
1921	23,346	30	4,982	28,358
1922	180,154	746	1,072	181,972
1923	94,471	8,685	396	103,552
1924	143,728	1,867	4,017	149,612
1925	92,816	642	2,138	95,596
1926	67,029	1,495	1,971	70,495
1927	72,006	2,133	646	74,785
1928	51,200	8,901	2,530	62,631
1929	111,218	9,899	3,023	124,140
1930	46,360	1,936	1,200	49,496
1931	10,880	3,807	151	14,838
1932	1,968	501	77	2,546
1933	1,685	75	132	1,892
1934	24,611	12	1,323	25,946

Table IV—Class and Number of Freight Cars Ordered in 1934

Class	U. S. railroads	U. S. private cars	U. S. total	Export	Canada
F—Flat	1,650	7	1,657	..	..
G—Gondola	2,075	2	2,077	..	..
H—Hopper	10,280	27	10,307	..	..
HR—Covered Hopper	165	..	165	..	..
R—Refrigerator	..	198	198	..	..
T—Tank	1	350	351	..	12
X—Box	9,053	14	9,067	855	..
XA—Automobile	550	..	550	20	..
XF—Furniture	200	..	200	..	..
Dump	10	..	10	8	..
N—Caboose	3	..	3	..	..
Fruit	..	..	..	40	..
Not classified	25	1	26	400	..
Total	24,012	599	24,611	1,323	12

Note:—Alaska included in United States Orders.

Several unusual runs were made during the past year, among which may be cited that on the Chicago, Milwaukee, St. Paul & Pacific between Chicago and Milwaukee, a distance of 85 miles, which was covered in 67 min. 35 sec. at an average speed of 75.5 m.p.h., with a top speed of 103 m.p.h. Some remarkable runs have also been made recently with steam locomotives in Great Britain and in Europe.

Accelerated train movements are by no means confined to passenger service; the records in freight service are as highly creditable. This is endorsed by the fact that the average speed of freight trains, which was 11.5 m.p.h. in 1924, has been steadily increased to 15.9 m.p.h. in 1934. Ample boiler capacity and large drivers are essential for the freight speeds now demanded. In recognition of this trend may be cited the 4-8-4 type locomotives built in 1934 for the Delaware, Lackawanna & Western and for the Lehigh Valley which will be used interchangeably for either heavy passenger or for fast freight service.

Freight Car Orders

Reference to an accompanying table shows a very favorable increase in the quantity of freight-car orders as compared with the other years following 1930. In 1930 freight-car orders totaled 49,496, or nearly double the number 25,946 for 1934. Recent years in which large numbers of freight cars were ordered were 1922, with 181,972 cars; 1924, with 149,612 cars, and 1929, with 124,140 cars.

As regard types, 10,472, or 42½ per cent, of those ordered last year were of the hopper type, 165 of which were of the covered type. Only 200 of the hopper cars ordered—those for the Central of Georgia—were of 70-ton capacity. Roads placing large orders for 50-ton hopper cars were the Lehigh & New England; Chesapeake & Ohio; Delaware, Lackawanna & Western, and Erie. A most interesting design of hopper car built in 1934 was one of light weight obtained by the employment of Cor-Ten steel. This was built by the Pressed Steel Car Company, and 100 cars of this design have been ordered recently by the Bessemer & Lake Erie.

Table V—Orders for Passenger Cars Since 1916

Year	Domestic	Canadian	Export	Total
1916	2,302	...	109	2,411
1917	1,124	...	43	1,167
1918	9	22	26	57
1919	292	347	143	782
1920	1,781	275	38	2,094
1921	246	91	155	492
1922	2,382	87	19	2,488
1923	2,214	263	6	2,483
1924	2,554	100	25	2,679
1925	2,191	50	76	2,317
1926	1,868	236	58	2,162
1927	1,612	143	48	1,803
1928	1,930	334	29	2,293
1929	2,303	122	33	2,458
1930	667	203	15	885
1931	11	11	21	43
1932	39	...	...	39
1933	6	...	...	6
1934	388	...	15	403

Next in quantity ordered for service in the United States came the box-car group, of which there were 9,067 and, in addition, 550 automobile and 200 furniture cars. These account for 40 per cent of the freight cars ordered. Roads placing large orders for box cars were the Chesapeake & Ohio, Erie, Pennsylvania and Seaboard Air Line.

Gondola cars ordered totaled 2,077, of which 1,000 were for the Chesapeake & Ohio, 675 for the New York, Chicago & St. Louis, 250 for the Lehigh Valley and 100 for the Lehigh & New England. Of the 1,657 flat cars specified, 1,500 were ordered by the Pennsylvania. Cars ordered by private car lines were mainly of the tank or refrigerator classes.

Passenger Car Orders

Domestic passenger cars ordered in 1934 totaled 388. Among the large orders were those of the Erie for 133 cars; Chicago, Milwaukee, St. Paul & Pacific, 85 cars, and New York, New Haven & Hartford, 50 cars.

(Continued on page 51)

New Haven Streamline Coaches Placed in Service

Exterior appearance improved by flush surfaces and approach to tubular cross-section — Unusual color scheme produces pleasing interior — Air conditioning provides maximum comfort — Weight reduction effected by the use of alloy steels

THE New York, New Haven & Hartford recently placed 50 new partially streamlined coaches in main-line service which were built to provide the maximum in comfort, convenience and attractiveness. In developing these cars the management of the New Haven called upon Walter Dorwin Teague, an outstanding industrial designer, to work out the details of the interior and exterior design so far as it affected appearance and the joint efforts of the builders—the Pullman Bradley Car Corporation—Mr. Teague and the railroad's engineering staff has resulted in a design as attractive as it is unusual. The cars were built at Worcester, Mass.

Partial streamlining has been effected by an approach to a tubular cross-section and by making the exterior surface as smooth as possible. These are important factors in the streamlining of railway equipment since the lateral surfaces of trains are disproportionately large as compared to the front and rear ends, and most winds are quartering. No overhanging eaves or protruding belt rails are in evidence. Windows and doors are as nearly flush as possible and the roofs are of the turtle-back type. Along each side of the cars, below the side sills and between the steps, is a skirt extending down to 22 in. from the rail, thus carrying downward the inward curve of the sides and covering most of the sub-structure. This device not only improves air-flow, but also gives the coaches a lower and much cleaner appearance The exterior color scheme is hunter's green and silver.

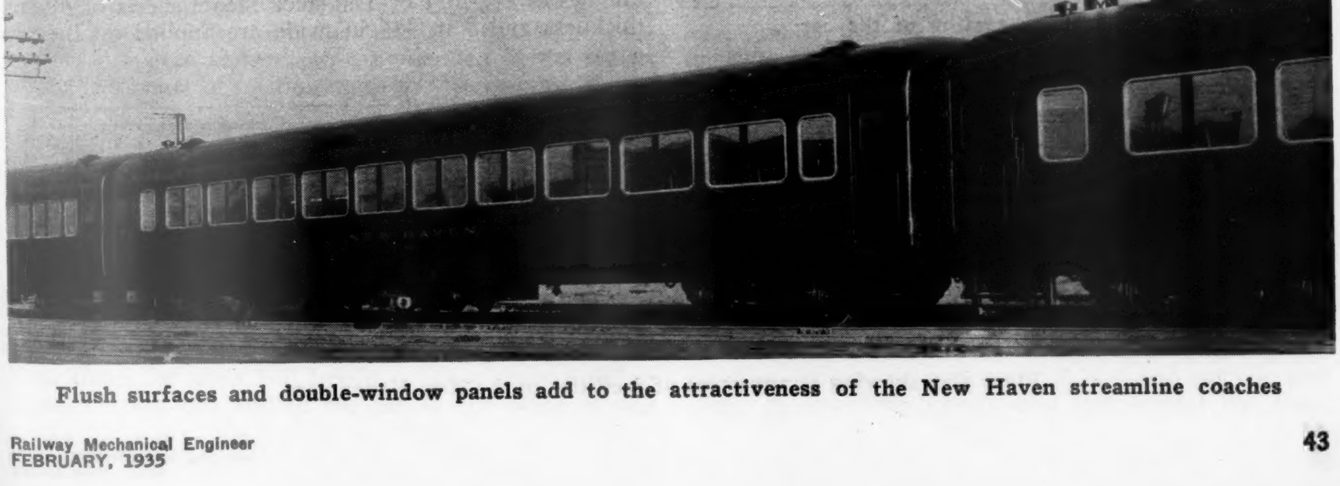
Windows have been grouped in pairs and outlined in brush-finished aluminum molding with rounded corners, to emphasize the horizontal lines of speed.

The coaches are 84 ft. 6¼ in. long over buffers, 13 ft. 4 in. from rail to top of roof, and 10 ft. ¼ in wide overall. The seating capacity is 84 passengers and the seats, which are spaced 39½ in. apart, are so arranged that they may be revolved independently. Men's and women's saloons are located at the same end of the car. The weight is approximately 100,000 lb.

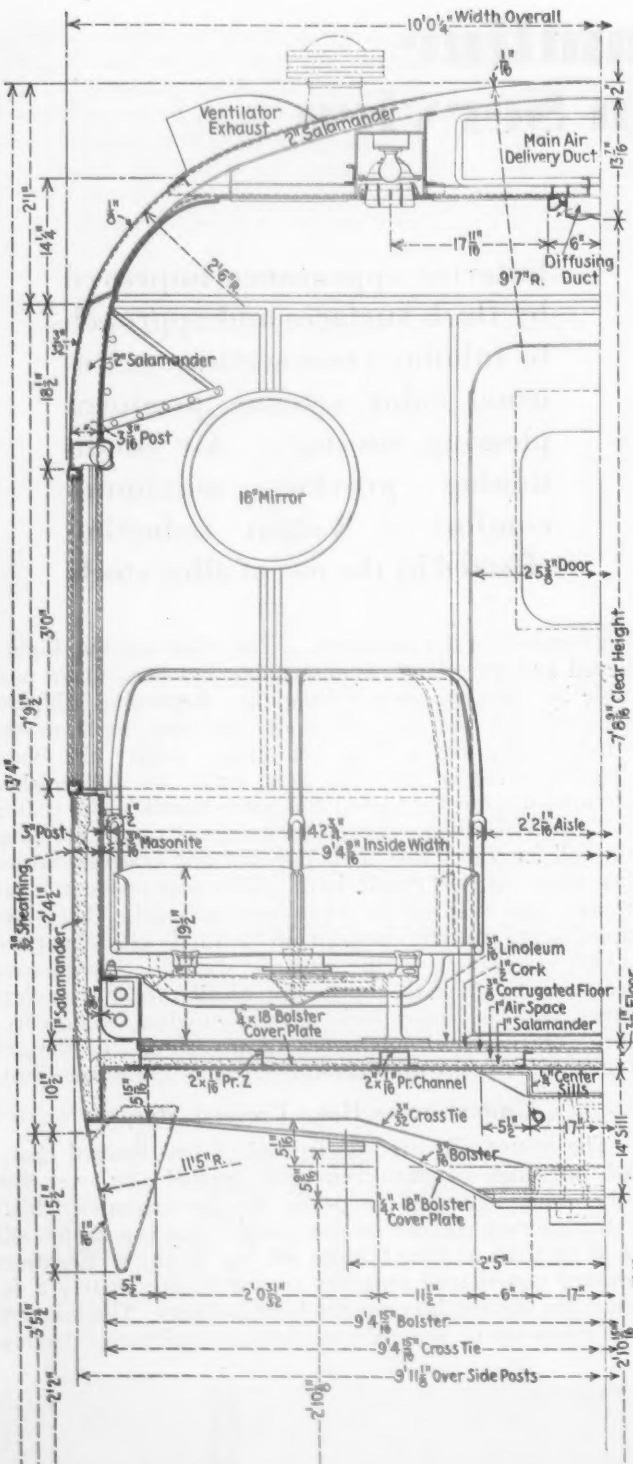
In the interior every effort has been made to insure the comfort of the passenger. The color scheme, higher keyed and gayer than is customary, has been made possible by complete air conditioning. Beginning with the tiles of rich blue on the floor, the side walls to the window sills are a deep blue-gray. Above the black Micarta window sills the side walls are full-finished aluminum up to the top of the frieze board. The ceiling is lacquered white. Three vermillion stripes extending the full length of the car counteract any coldness which the color scheme might have. The seats have tubular frames and rest on an aluminum pedestal. They are upholstered in blue mohair of a small check pattern which is repeated in the window shades. Special care has been taken with the design of all the interior features, such as basket rack, curtain molding, saloon fixtures, etc. The circular mirrors at each end of the car relieve the usually uninteresting effect of these partitions.

Underframes Have Pressed Shapes

The center sills are constructed of two flanged channel pressings of Man-Ten steel applied one over the other and separated vertically by the crossties which extend across the car in one piece. The top center sill is ¼ in. thick and the bottom sill 5/16 in. thick. Eighteen pressed pan-shaped crossties spaced approximately 3 ft. apart are applied between the body bolsters. The bolsters are made up of pressed pan-shaped diaphragms having



Flush surfaces and double-window panels add to the attractiveness of the New Haven streamline coaches



Half cross-section of the car

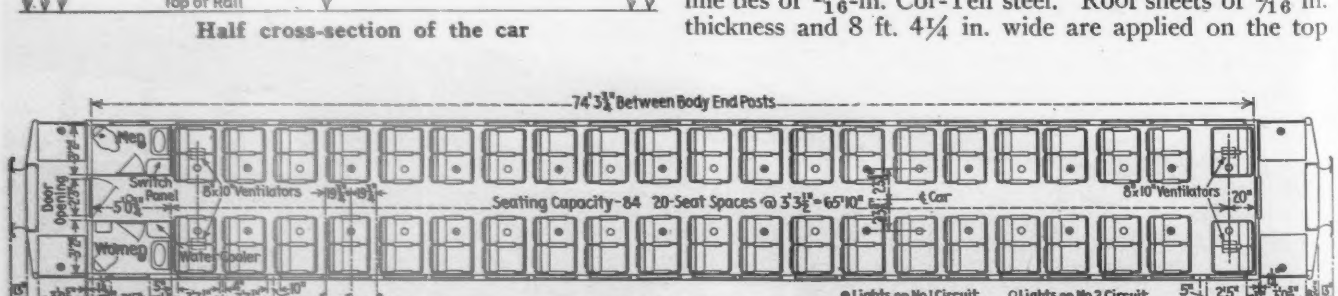
top and bottom cover plates. Pressed Man-Ten steel draft sills, 3/16 in. thick, extend from the bolsters to the ends of the car. These are secured between the top and bottom center-sill members, as are also the 3/16-in. pressed Man-Ten steel draft-sill extensions from the bolster to the first crosstie inside of the bolster. The side sills are a combined Z and channel-shaped pressing of 3/32-in. Cor-Ten steel riveted to the ends of the crossties, crossbearers and end sills. Three pressed Z-shaped floor stringers constructed of 1/16-in. Cor-Ten steel extend the full length of the car each side of the center, in addition to which there is a 1/16-in. Cor-Ten steel flanged channel floor stringer located under the seat pedestals. Beneath the floor stringers and applied directly to the top of the crossties, center sills and bolsters is a sub-floor of 20 gage Cor-Ten steel. Applied to the ends of the center sills is a cast-steel platform end casting in which are the buffer and draft-gear pockets.

The Superstructure

The side posts are constructed of Cor-Ten steel 3/32 in. thick. They are of box section 3/16 in. deep at their widest point. The bottoms of the side posts are curved in with a radius of 11 ft. 5 in., starting at a point 17½ in. above the bottom of the post. The tops of the posts are also curved inward with a radius of 2 ft. 5 11/16 in. Alternating posts are 10 in. wide and 4 in. wide, with flanges for attachment to the side plates. The belt rails are formed by two angle-shaped pressings. The horizontal flanges of the angles are coped out for the side posts and riveted together, forming a channel construction through which the side posts pass. The belt rails are further reinforced by means of a 3-in. by ¼-in. flat plate applied on the outside of the posts under the side sheets. The side plates are 3/32-in. Cor-Ten steel pressed Z-shape. Side sheets of 3/32-in. Cor-Ten steel extend from the bottom of the window openings to the bottom of the side sills, following the contour of the side posts. The letter boards are also constructed of 3/32-in. Cor-Ten steel, extending from under the down-turned flange of the side plate to the top of the window opening following the contour of the side posts. Applied directly over the window opening is a longitudinal reinforcement constructed of a pressed channel and angle having the horizontal flanges coped out for the posts and applied in the same manner as the belt rail. Pressed angle connections are applied to each post and belt rail as well as to each post and longitudinal stiffener.

Roof and Floor Construction

The roofs are of turtle-back construction. Twenty-five 1/16-in. Cor-Ten steel pressed channel-shaped carlines with bottom flanges are used. Extending across the car below the carlines in the car body are pressed carline ties of 1/16-in. Cor-Ten steel. Roof sheets of 1/16 in. thickness and 8 ft. 4¼ in. wide are applied on the top



Floor plan showing arrangement of facilities in the New Haven cars

An interior of one of the New Haven cars showing the lighting equipment, air distribution duct, seating arrangement and luggage racks. Weight has been reduced wherever possible by the use of light materials such as tubular seat frames of stainless steel and aluminum-alloy basket racks

of the car. Other roof sheets, 20 in. wide and 1/8 in. thick, extend from the lower edge of the center roof sheets to the top of the side sheets. There is a pressed channel purlin of 1/16-in. Cor-Ten steel located 19¾ in. each side of the center line of the roof, extending from end to end of the car body. Narrower purlins of the same material are also applied adjacent to the ends of the carline ties.

Applied over the longitudinal floor stringers is a steel floor having corrugations 3/8-in. deep extending across the car. Strips of cork 5/16-in. thick are cemented in the depressed portions of the steel floor plates on top of which is applied a continuous layer of cork ½ in. thick. The floor covering on 25 cars will consist of Linotile in 9-in. squares and in the other 25 cars, rubber tiles of the same size. Two shades of marbleized blue form a checkerboard pattern on the floor. Salamander, 1 in. thick, is applied on top of the sub-floor.

The Trucks

The cars are equipped with four-wheel trucks having 5-in. by 9-in. journals. The pedestals are cast integral with the truck frames. Forty of the cars have A.R.A. friction bearings and ten will have Fafnir roller bearings. The liberal use of Fabreeka pads has been made to absorb vibration and to eliminate rail noises. The brake cylinders are mounted on the truck frames with flexible hose connections in the brake-cylinder pipes. The generators are gear driven and are mounted in the trucks after the manner of traction motors. They are of 20-kw. capacity.

The Interior Finish

The inside finish from the under side of the window sills to the top of the stainless steel radiator guards is 3/16-in. Masonite covered with French gray lacquer. A 1/16-in. pressed-steel cove molding extends from the top of the floor to the bottom of the Masonite behind the heater pipes. The window sills are black Micarta over a wood base. The post covers are 1/16-in. steel with 2-in. flutes for their full height. The curtain molding extends from one end of the car to the other in one piece and is half oval shaped with a vertical flat surface 1½ in. wide. The frieze board from the top of the curtain molding to the horizontal portion of the ceiling is constructed of 1/16-in. steel formed to the contour of the top of the side posts and lower ends of the carlines.

The horizontal ceiling finish is 3/16-in. Masonite extending each side of the air-duct exhaust molding to the frieze boards. From the top of the window sill to the top of the frieze board the interior of the car is covered with aluminum lacquer. The horizontal portion of the ceiling is lacquered white. Vermilion stripes extend along the sides of the car below the window sills, on the flat vertical portion of the curtain molding and between the two upper half-round moldings on the frieze boards. On each end of the cars are two 18-in. diameter beveled plate glass mirrors mounted in aluminum frames. The vermilion striping and half-round moldings extend across the ends of the car and down to the mirrors. The doors are French gray to match the finish below the window sills. Mirrors 18 in. in diameter are also located over the washstands in the saloons. There is also in each saloon a 24-in. by 6-in. aluminum shelf with a black composition top. Paper towel vendors and soap vendors are furnished in addition to the hoppers and toilet-paper holders.

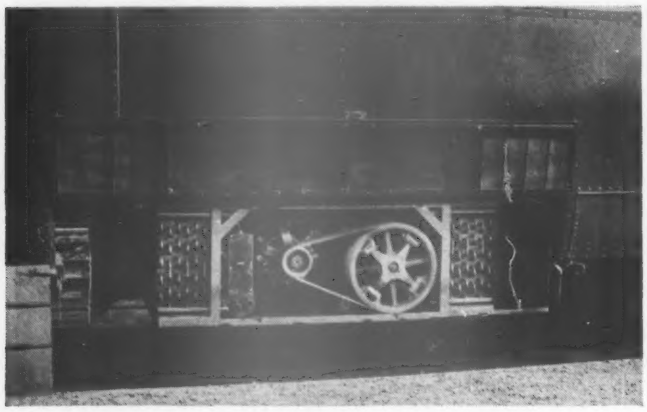
Seat Arrangement and Design

The seats are constructed with a semi-gloss stainless steel tubular frame extending across the top and down the sides of the seat backs as well as around the bottom of the seat cushions. Welded directly to the seat frames are stainless-steel arm rests having rounded composition caps on the top. Two separate back cushions and seat cushions are applied to each seat. Each seat may be revolved independently of the others. In order to provide the necessary clearance the revolving mechanism is so arranged that when the seat turns it automatically tips up at the back, which remains elevated until the turning is completed, when it falls back to its normal position where it is firmly locked. The seat upholstery material is a dark blue checked pattern, Mohair plush, having approximately four squares each of loop and cut pile per inch. A stationary center arm rest divides the seats,

with the exception of the bulkhead seats, which are narrower than the revolving seats.

Lighting

There is a light unit, containing a 25-watt lamp, for each seat in the car. Behind the lamp is an aluminum reflector and in front of it is a square louvre grille projecting slightly through the surface of the ceiling. The louvre allows for a sufficient distribution of the light and eliminates glare by protecting the passengers from a



The air-conditioning unit under the car

direct view of the light source. The portion of the grille below the ceiling line reflects a small amount of light laterally for illumination on the ceiling. No glass is used in the body fixtures.

Because of the water tanks and air-conditioning apparatus over the passageway and saloon ceilings a simple modern drop bowl type of lighting fixture was used at these places. All of the exposed metal parts of the fixtures are white, the same as the ceiling.

Basket Racks

The basket racks are constructed of aluminum alloy to save weight. They are made up in sections 3 ft. 3½ in. long, so arranged that when applied to the cars the joints come at the supports, giving the appearance of

Skirt panel raised to expose the truck

continuous racks in one piece from end to end of the cars. Applied to each of the basket-rack supports is also a clothes hook. The bottom flange for attaching the basket rack to the car extends down behind the curtain molding which covers up the attaching screw heads. The foot on the tension member is covered by the half-round snap-on moldings used for decorative purposes. The basket racks are of sufficient strength to withstand safely far greater loads than is possible to place in them.

Air-Conditioning Apparatus

The coaches are fully air conditioned, the electrical parts of the equipment being supplied by the General Electric Company and the evaporators by the B. F. Sturtevant Co. The equipment is designed for operation at 60 to 75 volts and the design of the evaporator was carefully matched up with the compressor to give an actual over-all capacity of seven tons.

Special Equipment on the New York, New Haven & Hartford Streamline Coaches

Truck frame	General Steel Castings Corp.
Truck brake	American Steel Foundries, Clasp brake
Wheels	Carnegie Steel Co.
Axles	Carnegie Steel Co.
Truck bearings	40 cars—A.R.A. friction 10 cars—Fafnir Bearing Co.
Truck springs	Railway Steel Spring Co.
Journal-box lids	National Malleable & Steel Castings Co.
Axle generator	General Electric, 20 kw.
Rubber pads	Fabreeka Products Corp.
Draft gears	Waugh Equipment Co., P-24-K
Couplers	American Steel Foundries
Coupler yokes	American Steel Foundries, Quad. shear
Buffers	Waugh Equipment Co., H-27
Vestibule diaphragms	Pullman Bradley Car Corp.
Vestibule tail gates	Pullman Bradley Car Corp.
Step treads	Kass
Vestibule flooring	Alan Wood Steel Co., Diamondette
Body Brake equipment	Westinghouse
Steam-heat equipment	Vapor Car Heating Co.
Steam train-line connections	Barco Mfg. Co.
Trap doors	Kass
Storage batteries	40 cars—Exide 5 cars—K-W 5 cars—Willard
Locking center pin	W. H. Miner
Saloon flooring	Tuco Products Corp., Flexolith
Insulation	Johns-Manville, Salamander
Window sills	Micarta, Westinghouse Elect. & Mfg. Co.
Window sash	Pullman Bradley Car Corp.
Saloon window glass	Pressed Prism Plate Glass Co.
Flooring	25 cars—Armstrong Linotile 25 cars—Hood rubber tile
Seats	Heywood-Wakefield Co.
Seat upholstery	20 cars—L. C. Chase 20 cars—Sidney Blumenthal 10 cars—Massachusetts Mohair Plush Co.
Window curtains	Pantasote Co.
Curtain fixtures	National Lock Washer Co.
Basket racks	Rostand Mfg. Co.
Lighting fixtures (car body)	Curtis Lighting, Inc.
Lighting fixtures (passageways and saloons)	Safety Car Heating & Lighting Co.
Body and saloon mirrors	Rostand Mfg. Co.
Saloon shelves	Adams & Westlake Co.
Saloon hoppers	Standard Sanitary Mfg. Co., Duner No. 7
Paper towel vendors	West Disinfecting Co.
Water cooler	Pullman Bradley Car Corp.
Drinking-cup vendor	United States Envelope Co., Ajax
Washstands	Standard Sanitary Mfg. Co.
Soap dispensers	West Disinfecting Co.
Toilet-paper holder	Morgan Envelope Co.
Exhaust ventilators	Pullman Bradley Car Corp.
Saloon ventilators	Pullman Bradley Car Corp.
Grilles	Tuttle & Bailey
Exterior lacquer	E. I. du Pont de Nemours
Interior lacquers	25 cars—E. I. du Pont de Nemours 25 cars—Murphy Varnish
Hardware	J. L. Howard Co.
Air-conditioning apparatus	General Electric Co. (Sturtevant)
Air-conditioning control panel	Vapor Car Heating Co.

Great pains were taken to insure the best possible air distribution, even to the extent of building a full size model interior of the car, in which various combinations of air distribution were tested. The final result was a center duct distributing system, in which the air is introduced into a pressure duct running the full length of the car. From this duct through a number of openings, an equal distribution down the length of the car is obtained to the lower or diffuser section, which extends below the headlining, and serves the purpose of gently

The end wall is decorated with a circular mirror and striping

diffusing the air into the passenger space with the least amount of draft, and at such an angle as to be unaffected by the baggage racks or articles contained therein. The diffusing duct is treated with Acousti-Celotex, in order to dampen any noise caused by the air entering at high velocity from the pressure duct. The fresh air intake is in the vestibule ceiling, a damper being provided to give a 25 per cent fresh air intake for normal operation, with provision for 40 per cent fresh air intake if the car is used as a smoker. The mixture of fresh and recirculated air is filtered by a dry type filter located just ahead of the cooling coil, and accessible through the recirculated air grille.

The evaporator units contain a cooling surface of the Sturtevant continuous plate-fin high pressure type. The tubes and fins are of copper, the tubes being brazed into the headers, and the fins amalgamated to the tubes through a coating of tin alloy. The entire cooling surface is built to withstand 250 lb. pressure.

The heating surface is of the square or plate-fin type, otherwise having the same general characteristics as the cooling surface. The fan and motor assembly consists of two Sturtevant Rexvane centrifugal fans mounted on a double extended shaft General Electric motor. The motor is of ½ hp., compound wound 60-volt, d.c., suitable for operation at 80 volts, so that it may be connected directly across the axle generator. The motor is fitted with sleeve bearings, with adequate oil capacity for operation over a period of six months without attention. The motor and fan are readily accessible and removable for maintenance.

The compressor and condenser unit is mounted underneath the car by means of rubber insulated bushings, so that vibration is not transmitted to the car superstructure. The compressor and motor are top supported, so that with the front and bottom covers removed from the unit, complete accessibility is provided for the inspection and adjustment of equipment. Any piece of equipment can be removed without the movement of any other equipment. The compressor is of the vertical reciprocating type, with four cylinders of 3¼ in. bore by 3¼ in. stroke. Force-feed lubrication is supplied to all of the bearings, including the wrist pins and shaft seal, by an oil pump driven by the crank shaft. The shaft seal is of the stationary-bellows type, with a special alloy self-alining nose piece of extra heavy section. The flange of the seal makes a rabbet fit into the crank case, thus holding the seal central at all times. Uniform and even pressure of the compression spring against the sealing surfaces is insured at all times. The flywheel which is driven from the compressor motor by a multiple V-belt drive floats on an external bearing lubricated from a separate oil reservoir into the end of the crank case. Torque is transmitted to the crank shaft through a four-stroke spider to the spokes of the fly wheel through composition bushings. This construction relieves the crank shaft and seal from shocks, vibration, belt tension and overhung weight of fly wheel.

The compressor motor is a d.c. compound-wound commutating-pole railway-type machine with rolled plate frame and anti-friction bearings at both pulley and commutator ends.

The condenser fan is mounted on the end of the compressor motor shaft and draws air into the unit over the compressor and motor, discharging it through the condensers which are located one on each end of the unit frame work. The condensers are of the air-cooled fin type, and are carried on a bottom support bolted to the unit framework in such a manner that either can be replaced without moving any other equipment. The usual high- and low-pressure cutouts are provided and are located in the unit framework. The generator is an axle-mounted 20-kw. machine.

The air-conditioning control is the Vapor Car Heating Company's combined heating and cooling control, mounted in a suitable locker inside the car. Four positions are provided for cooling and three for heating.

Forty of the cars are equipped with Exide batteries, arranged in two boxes, each holding 16 cells. Five cars have Willard and five have K-W. batteries.

2-8-2 Type Express Locomotive For L. & N. E. R.

First eight-coupled express locomotive in British service is of three-cylinder type and has 43,462 lb. tractive force

By E. C. Poultney

THE London & North Eastern Railway has recently placed in service the first eight-coupled passenger locomotive to be used in British railway service. It was designed by H. N. Gresley, chief mechanical engineer, L. & N. E. R., for the handling of express passenger trains over the 130-mile territory between Edinburgh (Waverly) and Aberdeen. Heavy grades are encountered in this district and the Pacific type passenger locomotives which are used in the same territory are required to haul trains of 540 (short) tons northbound from Edinburgh to Aberdeen, and 470 tons in the opposite direction. Since some of the more important express trains involve train loads of as much as 615 tons, exclusive of engine and tender, it has become necessary to provide locomotives of greater power in order to handle this traffic.

All important express trains on the L. & N. E. R. between London and Edinburgh and thence on to Aberdeen are handled by three-cylinder Pacific type locomotives which, when first built in 1922, had a rated tractive force of 29,835 lb.: cylinders, 20 in. by 26 in., with 80-in. driving wheels, and 180-lb. boiler pressure. Later locomotives were provided with boilers carrying 220-lb. pressure and equipped with 43-element superheaters instead of the 32-element type originally used. These locomotives developed a tractive force of 36,465 lb.

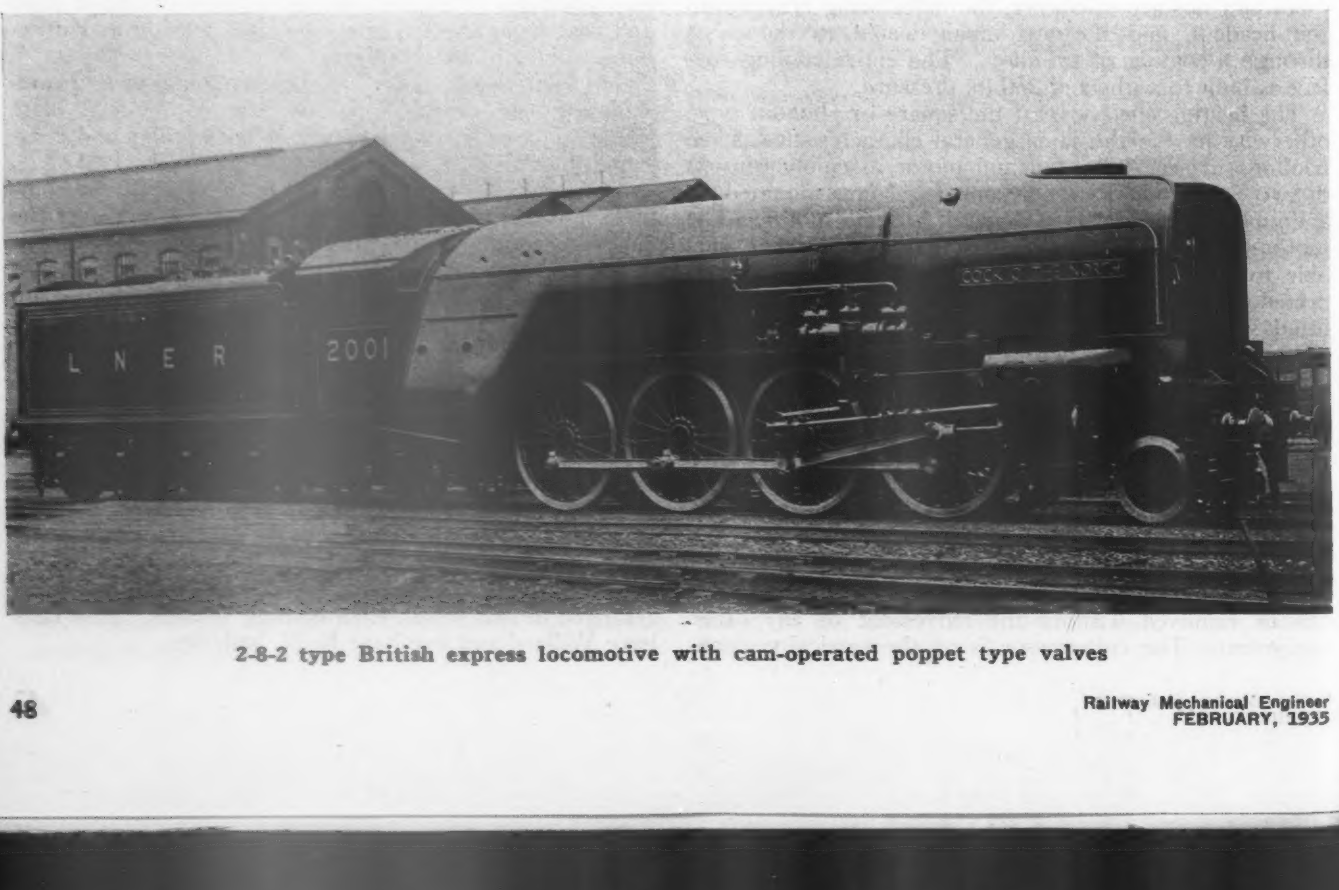
The new locomotive has a rated tractive force of 43,462 lb., which is greater than any other express passenger locomotive in the British Isles. In order that sufficient adhesion might be provided with a mean axle loading of 44,800 lb., eight-coupled wheels became necessary. This locomotive, therefore, has the further distinction of being the first eight-coupled express locomotive in British railway service. The weight on drivers is 180,544 lb., which is 73 per cent of the total engine weight of 246,960 lb., giving a factor of adhesion of 4.15. Because of limited clearances prevailing on British railways, the overall width is only 9 ft. and the maximum height 13 ft. 1 in.

Wheel Arrangement

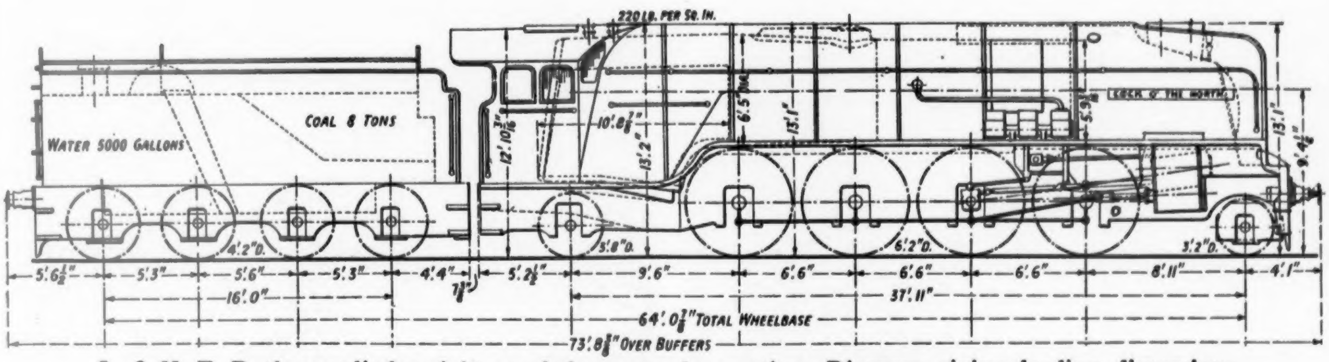
The wheel arrangement, 2-8-2, is unusual for an express locomotive, but it has the advantage, as compared with the 4-8-2 design, of effecting a reduction in wheel base. Further, its adoption made it possible to move the leading driving axle forward sufficiently to provide the necessary clearance for the center main rod and crosshead. The three cylinders are in line across the front of the engine, the two outside cylinders being inclined slightly at one in thirty. The center cylinder, in order to provide the necessary clearance between the inside rod and the front driving axle, is inclined 1 in 7.713.

Boiler and Superheater

The boiler carries 220-lb. working pressure. The barrel portion is in two sections, that next to the firebox being tapered and having a maximum diameter of 77 in., while the front course is cylindrical and has a diameter of $69\frac{5}{16}$ in. at the smokebox flue sheet. There are 121



2-8-2 type British express locomotive with cam-operated poppet type valves



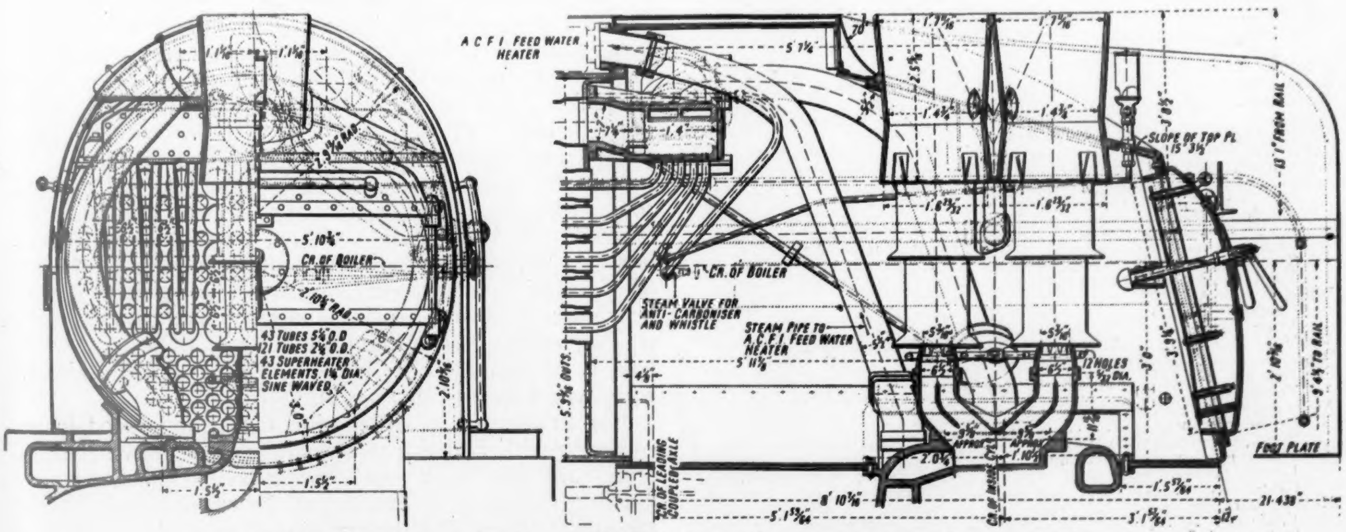
L. & N. E. R. three-cylinder eight-coupled express locomotive—Diagram giving leading dimensions

2¼-in. tubes and 43 5¼-in. flues for the type A superheater, which is of the latest pattern with Sinuflo elements having an outside diameter of 1¼ in., the elements being expanded into the header casting.

The dome which contains the throttle valve is of a novel form. Actually, the steam supply is taken from the boiler outside of the dome and enters it through a series of 18 slots in the top of the tapered section of the boiler barrel, which is reinforced at this point by a steel plate in which a corresponding number of slots are also cut and which is riveted to the inside of the barrel sheet. The object of the steam-collector arrangement is to deliver steam as dry as possible.

The grate area is 50 sq. ft.; the firebox heating surface, 237 sq. ft.; the total evaporative heating surface, 2,714 sq. ft., and the superheating surface, 635.5 sq. ft. The length between the tube sheets is 19 ft. The inside firebox is of copper, as is usual in British practice. The copper plates comprising the wrapper, back head and

been developed with the aid of wind-tunnel experiments to obtain an effective smoke lifter by the use of wing-plates. This together with the smooth finish given to the boiler jacket, which is specially shaped and finished off flush with the top of the pointed front given to the cab and without dome projection, provides a form of streamlining which should reduce air resistance at high speeds. The smokebox is equipped with a double stack and exhaust pipe. Each exhaust pipe is 6½ in. in diameter with 5³⁄₁₆-in. nozzles fitted with four adjustable, radial, wedge-shaped projections for splitting the exhaust jet. Above each exhaust nozzle is a bell mouthed petticoat pipe, each containing four tubes shaped into a form something resembling a four-leaf clover. Above this is a second petticoat pipe without division plates. The small diameter of each stack is 16¾ in. This double exhaust arrangement, known as "Kylchap" or "K.C.," was developed by Mons. Chapelon on the Paris-Orleans railway and has since been adopted by a number of European



Arrangement of smoke box with Kylchap exhaust system and twin stacks

throat sheet are ⁹⁄₁₆ in. thick, and the dished tube sheet is 1¼ in. thick. The firebox at the mud ring inside is 86 in. long by 83¾ in. wide. The safety valves are of the pop type, two in number, and 3½ in. in diameter. Boiler feed is provided by an A. C. F. I. feedwater heater, the pump portion being mounted on the right-hand side, and the mixing chamber fitted in saddle form on the top of the boiler barrel at the front end. An injector is fitted for use when required. Alfol insulation has been used for covering the boilers.

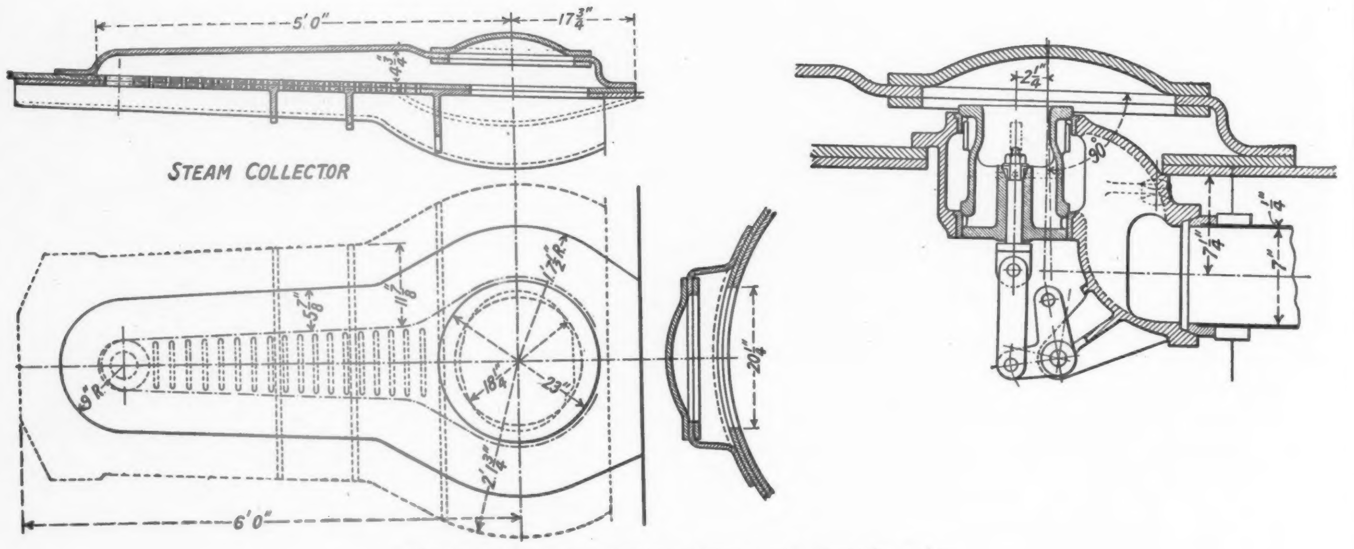
Much care and consideration has been given to the design of the front end, the outside form of which has

roads. It is reported that the design has provided an excellent draft with unusually low back pressure.

Cylinders and Valve Gear

The three cylinders each have a diameter of 21 in., with a piston stroke of 26 in., and the steam distribution is effected by poppet valves actuated by rotating camshafts. The cylinders, complete with valve chests, are a single iron casting, the upper part of which forms the smokebox saddle.

The steam ports and passages, both inlet and exhaust, provide large and direct passages from the throttle in the



Details of steam collector, dome and throttle valve

dome through to the exhaust. The dry pipe to the superheater has an inside diameter of 7 in. and the two branch pipes in the smokebox are each 5½ in. diameter inside. The double-beat poppet valves for admission have a diameter of 8 in. and those for exhaust are 9 in. diameter. All three cylinders take steam from a common steam chest formed in the upper part of the cylinder casting, to which the two steam pipes from the superheater connect. The exhaust passages from each cylinder join in a cavity arranged centrally at the top of the middle cylinder just below the base of the double exhaust pipe casting.

Principal Dimensions and Weights of the L. & N. E. R. Three Cylinder 2-8-2 Type Express Locomotive

Road	London & North Eastern
Service	Express passenger
Rated max. tractive force	43,462 lb. (at 85 per cent boiler pressure)
Weight on drivers ÷ max. tractive force	4.15
Cylinders, dia. and stroke	3-21 in. by 26 in.
Valve gear, type	Rotary cam
Weights in working order:	
On drivers	180,544 lb.
On front truck	25,760 lb.
On trailing truck	40,656 lb.
Total engine	246,960 lb.
Tender (loaded)	123,872 lb.
Total engine and tender	370,832 lb.
Wheels: diameter:	
Coupled	74 in.
Front truck	38 in.
Trailing truck	44 in.
Wheel bases:	
Driving	19 ft. 6 in.
Total engine	37 ft. 11 in.
Boiler:	
Steam pressure	220 lb.
Tubes, number and diameter	121—2¼ in.
Flues, number and diameter	43—5¼ in.
Length between tube sheets	19 ft. 0 in.
Grate area	50 sq. ft.
Heating surfaces	
Firebox	237 sq. ft.
Tubes and flues	2,477 sq. ft.
Total evaporative	2,714 sq. ft.
Superheating surface	635.5 sq. ft.
Comb. evap. and superheat	3,349.5 sq. ft.
Tender:	
Water capacity	5,000 Imp. gal.
Coal capacity	17,920 lb.

Each cylinder has four poppet valves, two at each end. One serves for admission and the other for exhaust. All 12 valves work longitudinally in a horizontal plane with their spindles parallel. To operate the valves two camshafts are used, with the required driving gears enclosed in cam boxes. The camshaft on the right-hand side is fitted with cams controlling the steam and exhaust valves for the outside cylinder, and those for the exhaust for the center cylinder, while on the left-hand side the camshaft controls the steam inlet and exhaust for the outside cylinder and, in addition, those for the steam admission for the center cylinder. This poppet valve mechanism is known as the R. C. poppet valve gear and is supplied by the Associated Locomotive Equipment Company, Ltd.

The main rods drive through the second pair of coupled wheels, that from the center cylinder by means of a built-up crank axle, with balanced cranks, having a main pin 9¼ in. by 6 in. The two outside crank pins are 6¾ in. by 6 in. The side rod pins are 7½ in. by 4½ in. for the main drivers; 4¾ in. by 4 in. for the leading wheels, and 4¾ in. by 5 in. for the others. The 74-in. drivers are mounted on axles with 9½-in. by 11-in. journals, and the spring suspension is by means of underhung laminated springs having 3-ft. 6-in. centers. Compensated or equalized spring rigging is not fitted.

For the leading truck 38-in. wheels are used and the journal bearings are 6½ in. by 9 in., the weight being taken in this instance by coil springs, two to each truck box. At the trailing end flexibility is obtained by the use of Cortazzi boxes, having 6-in. by 11-in. journals with overhung laminated springs, 4-ft. 6-in. centers. The trailing wheels have a diameter of 44 in. The total wheel base of the engine only is 37 ft. 11 in., and of this the rigid wheel base is 19 ft. 6 in.

For lubrication of all motion parts oil is used in accordance with British practice and, where convenient, oil boxes are used with pipe connections to the details requiring continuous supplies of lubricant, such as the crosshead shoes. On the right-hand side, above the running board, two mechanical lubricators are fitted. These supply oil to the driving boxes as well as to the cylinders and poppet-valve spindles.

The eight-wheel tender has a water capacity of 5,000 Imp. (6,000 U. S.) gallons, and there is space for eight long or nine short tons of coal. It runs on eight 50-in. diameter wheels, not in trucks. The wheel base is 16 ft. and rigid, except for the lateral play allowed in the boxes. The weight is taken by overhung laminated springs. A water scoop is provided. The brakes are of the automatic vacuum type.

This locomotive, of which the principal dimensions appear in the accompanying table, was built at the company's Doncaster shops. The next locomotive to be built will be equipped with Walschaert valve gear and piston

valves so that comparative results can be obtained in service.

Results of Experimental Run

Shortly after the locomotive had been broken in a trial run was made from London (Kings Cross) to Barkston and return, a total distance of 219 miles. The train was composed of 18 coaches and a dynamometer car, the total weight of the train, including the locomotive, being 912 short tons, of which 727 tons was back of the tender. The first 13 miles was on a rising grade, 0.95 per cent near the start and later, for 7.7 miles, at 0.5 per cent. On this 7.7 miles the speed averaged 53.3 m.p.h. and the cut-off from 20 to 22 per cent. A stop was made at Peterborough, 76.4 miles from the start, the running time (including a slow down) being 81 min. 46 sec. and the average running speed 56 m.p.h. For a considerable portion of the distance running was done at a cut-off of not over 10 per cent.

The next 24 miles was up grade, the last 15 miles being 0.5 to 0.56 per cent. On this latter portion the speeds ranged from 58 to 62 m.p.h., drawbar pulls from 10,000 to 13,000 lb. and drawbar horsepower from 1,500 to 2,100.

Starting drawbar pulls of from 31,000 to 36,600 lb. were recorded. No attempt at fast running was made, although speeds between stations of from 70 to 76 m.p.h. were recorded. Later, in regular service a speed of 86 m.p.h. was recorded on the 0.5 per cent down grade approaching London. Coasting speeds in excess of 60 m.p.h. for long distances were easily made—with steam shut off the exhaust poppet valves being held off their seats with the valve gear in central position.

The outstanding feature of the run was the high sustained horsepower developed, 0.63 drawbar horsepower per square foot of combined evaporative and superheating surface or, in other words, a drawbar horsepower was developed for each 1.59 sq. ft. of combined heating surface.

Equipment Orders Show Large Increases

(*Continued from page 42*)

There was one order for 15 cars to be exported to Chile. No passenger cars were ordered for service in Canada.

As regards classes of cars, there were 304 coaches; 24 passenger and baggage cars; and 37 baggage, mail and express cars. The balance were of various types, most of them being for special service trains.

The influence of the movement toward lighter trains which was initiated in the articulated streamline motor trains was reflected in passenger cars ordered in 1934. The possibilities of reducing weight without sacrifice of structural strength which new materials have made available have been, or are being, employed along with modifications in shape and smooth exterior surfaces in the case of several of the orders. In one case the coaches are being built for operation in fully streamline trains to be hauled by streamline rail motor cars—trains which will be much like the articulated units except for the greater flexibility and increased weight of the independent coach units. These coaches, however, will represent a reduction of 15 to 20 tons in weight as compared with a conventional steel passenger coach of moderate weight and thus materially improve the rate of acceleration and speeds which can be obtained in Diesel-electric motor-train operation.

Table VI—Orders for Articulated Motor Trains, Rail-Motor Cars and Trailers

	1922	'23	'24	'25	'26	'27	'28	'29	'30	'31	'32	'33	'34
For service in U. S....	51	77	120	149	142	180	175	132	54	26	15	18*	14†
Canada...	7	3	12	7	4	9	10	10	8	4	4	..	..
For export..	1	22	...	34	32	12	9	28	3	10	2	3	..
Total...	59	102	132	190	178	201	194	169	65	40	21	21*	14†
Motor trains and cars..	50	93	112	171	161	176	172	159	56	40	20	17*	13†
Trailers.....	9	9	20	19	17	25	22	11	9	..	1	4	1‡

* Includes three articulated trains.
† Includes seven articulated trains.
‡ This is a body unit for addition to an articulated train.

Activity in the air-conditioning field during 1934 brought the total cars so equipped and in service at the close of the year to more than 2,500. Of these 1,878 were placed in service last year. At the close of 1933 there were 648 air-conditioned cars in service. Of the total Pullman and railroad-owned cars fitted with air-conditioning equipment last year 932 were equipped with mechanical refrigeration systems, 749 with ice refrigeration and 197 with steam-ejector systems.

Articulated Motor Trains and Cars

During 1934 the steam railways of the United States ordered seven articulated motor trains, six rail motor cars and one additional body unit for an articulated train, a total of 14 self-propelled train or car units, as compared with 18 during 1933, only three of which were articulated trains. No orders were placed last year for equipment of this type for export and none was ordered in Canada. Details of the orders for rail motor cars and trains are given in an accompanying table.

Table VII—Orders for Articulated Motor Trains and Rail-Motor Cars for Service in the United States

Road	No.	No. Car Units Each	Type of Power Plant	Horse-power	Seating Capac.	Length of Bagg. Compt. Ft.	Length of Bagg. Compt. In.	Weight	Builder
Boston & Maine.................	1AC	3	Oil-Electric	600	144	10	8	207,619	Winton-General Electric-Budd
	1	1	Oil-Electric	800	...	35	11	200,000	Ing.-Rand-General Electric-St. L. Car
	1	1	Oil-Electric	800	...	35	11	200,000	Westinghouse-St. L. Car
Chicago, Burlington & Quincy....	2	3	Oil-Electric	600	88	28	0	210,000	Winton-General Electric-Budd
	*1	Coach Body	....	...	40	..	..	......	Budd
Gulf, Mobile & Northern.........	2	2	Oil-Electric	660	...	31	8½	168,000	McI. & Sey.-West.-American
Illinois Central..................	1	5	Oil-Electric	1,200	148	21	0	493,000	Winton-General Electric-Pullman
New York, New Haven & Hartford	1AC	3	Oil-Electric	800	164	..	..	250,000	Westinghouse-Goodyear
Norfolk Southern................	2	2	Gasoline	168	53	12	11	41,400	Hall Scott-Brill
Union Pacific....................	†2	10	Oil-Electric	1,200	104	54	5	......	Winton-General Electric-Pullman

* Stainless Steel, for addition to an articulated train. † 8 of the 20 cars in these 2 trains are being built for the Pullman Co.

North Western "400" High-Speed Train

Reconditioned six-car steam trains average 60.5 m. p. h. on 408.6-mile runs between Chicago and St. Paul, not including three intermediate stops

THE first high-speed standard steam-driven passenger train, designed to compete with streamline light-weight Diesel-electric equipment, was recently placed in service on the Chicago & North Western line between Chicago and St. Paul, Minn. The equipment has been refurnished with modern appointments and decorations and is air-conditioned throughout. To operate this service four 148-ton Pacific type locomotives with 26-in. by 28-in. cylinders have been fitted with 79-in. driving wheels and with oil-burning equipment.

The distance from Chicago to St. Paul, over the North Western line via Milwaukee, Wis., is 408.6 miles, and the scheduled operating time of the new service, including stops at Milwaukee, Adams and Eau Claire, is 7 hr., which cuts 2 hr. 50 min. from the fastest previous North Western schedule. This is an overall average of 58.4 m.p.h. Deducting 15 min. for three intermediate stops, the running time averages 60.5 m.p.h. The 85-mile run from Chicago to Milwaukee is made in 80 min., or 10 min. less than the fastest previous schedule. The trains depart from Chicago and St. Paul, respectively, at 3:30 p.m. and both arrive at St. Paul and Chicago at 10:30 p.m. Departure from Minneapolis is one-half hour earlier and arrival one-half hour later than at St. Paul.

Class E-2 Locomotives Conditioned for High Speeds

The four Pacific type locomotives, of the E-2 Class, built by the American Locomotive Company in 1923, were taken into the Chicago shops at the C. & N. W. and conditioned for high-speed service, the alterations and conditioning work being done in a period of 60 days and at a cost of $14,000 per locomotive.

The reconditioned Class E-2-A locomotive is of conventional design, develops a tractive force of 45,800 lb., and weighs 295,000 lb., of which 178,000 lb. is on the driving wheels. The total weight of the engine and tender loaded is 592,000 lb. No change was made in the locomotive boiler except to increase the steam pressure from 210 to 225 lb., which could be done and still maintain an adequate factor of safety. The combined heating surface of the boiler, including tubes, flues, thermic syphons, firebox and combustion chamber, is 3,235.2 sq. ft. A new type of superheater unit, known as the H-A-4, recently developed by the Superheater Company was installed for test purposes on one locomotive to demonstrate the possibility of obtaining a higher superheated steam temperature without any radical change in boiler design.

To facilitate operating at high speeds the locomotive was equipped with larger driving wheels of the Boxpok type made by the General Steel Castings Corporation, the outside wheel diameter being increased from 75 to 79 in. The valve gears on this class of locomotive had previously been adjusted to give more power and smoother running at high speeds. The valve events have been changed as follows: Steam lap, 1⅜ in. to 1⅞ in.; forward lead, ³⁄₁₆ in. to ¼ in.; backward lead, ⁹⁄₁₆ in. to ¼ in.; valve travel, 9 in. to 7¾ in.; exhaust clearance, ⅛ in. to line and line.

The main driving wheels were carefully cross-counterbalanced to assure smooth operation of the locomotive at high speeds and to produce a minimum of stress in the track structure. The conventional method of balancing 50 per cent of the reciprocating weights was followed. However, on account of the cross-counterbalancing on the main wheels the actual proportion of the reciprocating weights balanced was reduced to 35.1 per cent. Because of the increase in steam pressure and consequent heavier piston thrust the piston-rod diameter was increased ¼ in. New main driving axles, crank pins and piston rods were applied throughout, being made of a 100,000-lb. high-tensile steel furnished by the Standard Steel Works.

The locomotive was converted from coal to oil burning to avoid the necessity of making stops en route for fuel and for ash-pan cleaning. Other special equipment installed on the locomotive included a Wilson blow-off cock muffler, Barco low-water alarm, Franklin Type E-2 radial friction buffer, and Hunt-Spiller Duplex valve and piston packing. One of the locomotives was equipped with Smith high-speed piston valves for test purposes. Special superheat valve oil and driving journal grease, as well as fuel oil used on the locomotives, are furnished by the Standard Oil Company.

Important changes were made in the tender, the tank of which was increased to 34 ft. 10½ in. in length by inserting a new 6-ft. section in the center and welding the entire tank on a Commonwealth one-piece cast-steel tender frame furnished by the General Steel Castings Corporation. The four-wheel tender trucks formerly used on the Class E-2 locomotive tenders were replaced by Commonwealth six-wheel tender trucks. The reconstructed tank has a capacity of 15,000 gal. of water and is provided with an oil cistern, fitted in the coal space, which will hold 5,000 gal. of fuel oil.

How the Operating Schedule Was Set Up

The "400" was scheduled only after numerous conferences between the engineering, mechanical and operating officers, during the course of which it was decided to have the north and southbound trains meet at Adams, Wis., approximately half way between Chicago and Minneapolis. The North Western line, for about 50 miles on either side of Adams, is single track, but the meeting and passing of these high-speed trains has been worked out so as to avoid any delay. The northbound train leaves Adams just as the southbound train arrives. A passing track of ample capacity is provided, with a penstock between the main line and the passing track to permit either train to take water..

So carefully have preliminary arrangements been made that during the first month of operation the

One of the Class E-2-A oil-burning locomotives which handle the C. & N. W. "400"

meeting at Adams has been effected without any delay to either train on the part of the other. Moreover, the entire high-speed operating schedule has been successfully maintained with the exception of two relatively minor delays due to exceptionally adverse weather conditions and one delay due to a truck failure on a freight train.

Both the locomotives and the engine crews of the "400" are changed, each way, at Milwaukee, thus meeting crew-change requirements and providing a reserve of power in case of emergency. Another important advantage of this arrangement is that a full tank of water can be obtained for outgoing locomotives without delay and without the expense of installing water penstocks at the Milwaukee passenger station.

In addition to Milwaukee and Adams the scheduled stop at Eau Claire is utilized to take water, thus making, in effect, three places at which water is taken during each one-way trip of 408.6 miles. The total consumption of water is approximately 32,000 gal. per trip. No stops for fuel are necessary as the locomotives are arranged to burn fuel oil and the capacity of the oil cistern on each tender is almost adequate for a complete round trip. The oil consumption is about 2,740 gal. per one-way trip.

The six standard steel railway cars, which comprise the "400," weigh 456.7 tons and the locomotive and tender, loaded, weigh 296 tons, or a total of 752.7 tons. Under maximum load conditions with about 275 passengers on the train the unit weight is slightly under three tons per passenger.

In reconditioning the coaches for use on the "400" trains air-conditioning equipment was installed in all cars. The interiors were completely redecorated in bright colors, seats re-upholstered, curtains renewed, hot and cold water provided in the coach lavoratories, and modern drinking fountains and radio equipment installed. The only changes in the running gear consisted of the application of special side bearings designed by a Chicago & North Western truck-shop foreman and now being marketed by the Railway Products Company. These side bearings have been tested on the North Western for four years and besides eliminating side-bearing pounds are said to provide sufficient take-up to eliminate constant attention and adjustment usually necessary to assure a quiet, easy-riding car.

Principal Dimensions, Weights and Proportions of the C. & N. W. Class E-2-A 4-6-2 Locomotives

Builder	American
Service	Fast passenger
Cylinders, diameter and stroke	26 in. by 28 in.
Valve gear, type	Walschaert
Valves, piston type, size	12 in.
Weights in working order:	
Total engine	295,000 lb.
On drivers	178,500 lb.
On front truck	58,000 lb.
On trailing truck	58,500 lb.
Tender	297,000 lb.
Wheel base:	
Driving	14 ft.
Rigid	14 ft.
Engine, total	37 ft. ½ in.
Engine and tender, total	77 ft. 5⅞ in.
Wheels, diameter outside:	
Driving	79 in.
Front truck	36 in.
Trailing	50 in.
Journals, diameter and length:	
Driving, main	11⅝ in. by 13 in.
Driving, others	10½ in. by 13 in.
Front truck	6½ in. by 12 in.
Trailing truck	9 in. by 14 in.
Boiler:	
Type	Conical
Steam pressure	225 lb.
Fuel, kind	Oil
Diameter, first ring, outside	76 7/16 in.
Firebox, length and width	116⅛ in. by 74¼ in.
Tubes, number and diameter	202 — 2 in.
Flues, number and diameter	40 — 5⅜ in.
Length over flue sheets	18 ft.
Grate area	63.1 sq. ft.
Heating surfaces:	
Firebox and comb. chamber	278.0 sq. ft.
Thermic syphons	74.0 sq. ft.
Total firebox	352.0 sq. ft.
Tubes and flues	2,883.2 sq. ft.
Total evaporating	3,235.2 sq. ft.
Superheating	882.0 sq. ft.
Comb. evap. and superheat	4,117.2 sq. ft.
Tender:	
Water capacity	15,000 gal.
Fuel capacity	5,000 gal.
General data and proportions:	
Rated tractive force	45,800 lb.
Weight on drivers ÷ tractive force	3.9
Tractive force × dia. drivers ÷ comb. heat. surface	878.8

Ice-Activated Air Conditioning

The air-conditioning system is of the ice-activated type designed by the Chicago & North Western and utilizing air-conditioning units furnished either by the Young Company, Racine, Wis., or the Trane Company, La Crosse, Wis. The system includes two ice bunkers of 1,600 lb. capacity each, located under each car and a 30-gal. sump between the bunkers. A Chicago water

Interior of one of the coaches on the "400"

pump driven by a Baldor ½-hp. electric motor delivers the chilled water to the overhead air-conditioning unit located in the clerestory at one end of the car. Air circulation is provided by means of a direct-connected motor-driven double-blower unit of 2,000 cu. ft. per min. capacity. From a pressure chamber the air is distributed through ducts along the sides of the clerestory to Uniflo grilles, through which it is distributed to the car body and, in the case of the lounge coach, also the men's and women's lounges.

About 75 per cent of the air is recirculated, a proportion which can be increased in extremely cold weather by a manually operated damper. To revitalize the recirculated portion of the air before it re-enters the car a machine, made by the Ozone Pure Airifier Company, is installed in the air chamber just behind the blower fan to furnish oxygen, an arrangement which eliminates the musty odors sometimes encountered in air-conditioned cars.

Interior temperature control is effected by a Vapor automatic by-pass valve, thermostatically controlled, which returns water directly to the sump without passing through the air-cooling unit if the temperature of the water passing through the unit is not raised to over 50 deg. The interior temperature is selected manually from three positions on the temperature control. For outside temperatures of 75 to 80 deg. F. the low-setting is for 71 deg. F.; for outside temperatures of 80 to 85 deg. F., a medium inside temperature of 75 deg. F. is available, and for temperatures over 90 deg. the high temperature setting is at 80 deg. F. For outside temperatures of 70 to 75 deg. fresh air only is needed in the car for air-conditioning purposes, and a device with auxiliary outside air intake and two sets of dampers are provided, one controlling the intake and the other the recirculated air. This device, under thermostatic control, opens the auxiliary outside intake and closes the recirculating air grille when the outside temperature lies without the limits mentioned.

Each of the trains consists of a 70-ft. 3-in. passenger-baggage car, with seats for 50 persons; a coach 54 ft. 2 in. long, with seats for 60; a lounge coach 73 ft. 4½ in. long, with seats for 48 passengers in the main compartment, six in the women's lounge and seven in the men's lounge; a 73-ft. dining car, with tables for 36 persons; a 70-ft. parlor car, with a seating capacity of 42, which includes 23 individual chairs in the main parlor section, two sofas in the men's room and 11 seats in the smoking room, and a 78-ft. 3½-in. observation-parlor car, with seats for 12 in the forward compartment, 11 in the observation end, five in the drawing room and eight in the solarium.

Annual Report of the Bureau of Locomotive Inspection

Twenty-third annual report again shows an increase in percentage of defective locomotives and number of accidents

THE twenty-third annual report of A. G. Pack, chief inspector, Bureau of Locomotive Inspection, to the Interstate Commerce Commission shows that the record of improvement in the condition of steam locomotives and the casualties and accidents resulting therefrom which began in 1923 was continued steadily until 1932. In 1933 conditions began to get worse and this trend is again reflected in the current report which covers the activities of the Bureau for the fiscal year ended June 30, 1934.

The total number of steam locomotives inspected by the Bureau during the past fiscal year was 89,716, of which 10,713, or 12 per cent, were defective. This compared with 8,388 defective locomotives in the year ended June 30, 1933, and 7,724 in the previous year. The number of locomotives ordered out of service increased to 754 against a low of 527 in 1932, while the total number of defects found was 43,271 against 27,832 in 1932 and 32,733 in 1933. The number of accidents due to defective locomotives showed a considerable increase, but, fortunately, the number of people killed or injured was not greater than last year.

During the year 12 per cent of the steam locomotives

Front key between frame and cylinder saddle worked out. Repairs effected by inserting a new key made of crank-pin grease

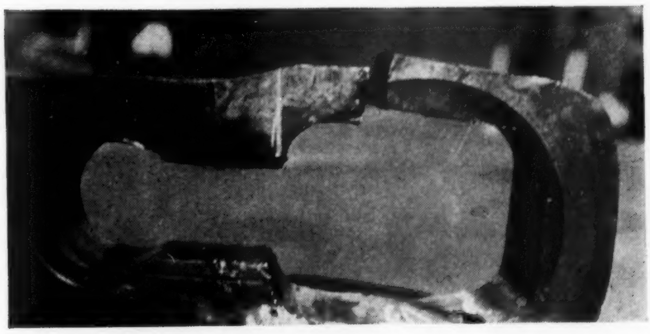
Condition of Locomotives, Found by Inspection, in Relation to Accidents and Casualties

Fiscal year ended June 30	Per cent of locomotives inspected found defective	Number of locomotives ordered out of service	Number of accidents	Number of persons killed	Number of persons injured
1925	46	3,637	690	20	764
1926	40	3,281	574	22	660
1927	31	2,539	488	28	517
1928	24	1,725	419	30	463
1929	21	1,490	356	19	390
1930	16	1,200	295	13	320
1931	10	688	230	16	269
1932	8	527	145	9	156
1933	10	544	157	8	256
1934	12	754	192	7	223

inspected were found with defects or errors in inspection that should have been corrected before the locomotives were put into use as compared with 10 per cent in the

Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing or in violation of rules	Year ended June 30— 1934	1933	1932	1931	1930	1929
1. Air Compressors	660	474	417	481	873	1,202
2. Arch tubes	127	51	54	60	87	104
3. Ash pans & mechanism	87	40	69	81	76	132
4. Axles	6	21	13	10	12	20
5. Blow-off cocks	289	210	144	191	325	442
6. Boiler checks	407	293	214	263	521	761
7. Boiler shell	372	296	220	430	579	841
8. Brake equipment	2,326	1,696	1,645	1,923	2,706	3,894
9. Cabs, cab windows and curtains	1,342	1,183	851	1,484	3,066	2,140
10. Cab aprons and decks..	343	309	262	415	710	1,005
11. Cab cards	129	121	162	211	226	305
12. Coupling and uncoupling devices	54	67	85	98	122	154
13. Crossheads, guides, pistons, and piston rods	1,100	773	763	856	1,421	1,887
14. Crown bolts	77	67	50	96	95	129
15. Cylinders, saddles, and steam chests	1,491	1,084	841	1,265	2,311	3,210
16. Cylinder cocks and rigging	654	374	376	411	848	967
17. Domes and dome caps.	105	76	45	83	154	227
18. Draft gear	401	318	325	568	950	1,310
19. Draw gear	480	357	371	640	1,003	1,367
20. Driving boxes, shoes, wedges, pedestals, and braces	1,472	1,080	821	925	1,359	1,993
21. Firebox sheets	356	246	235	341	471	657
22. Flues	203	150	120	187	254	334
23. Frames, tailpieces, and braces, locomotive .	951	669	611	740	1,271	1,377
24. Frames, tender	128	80	86	105	177	297
25. Gages and gage fittings, air	212	145	156	192	290	309
26. Gages and gage fittings, steam	289	258	214	324	553	678
27. Gage cocks	384	388	330	415	783	1,114
28. Grate shakers and fire doors	404	245	288	410	767	295
29. Handholds	377	363	382	562	865	1,125
30. Injectors, inoperative..	33	20	31	55	103	86
31. Injectors and connections	1,909	1,357	1,168	1,815	3,275	4,484
32. Inspections and tests not made as required	8,173	6,358	3,801	4,862	7,456	9,246
33. Lateral motion	351	269	237	289	372	618
34. Lights, cab and classification	79	76	55	77	119	121
35. Lights, headlights	218	169	119	180	373	488
36. Lubricators and shields	215	157	119	176	312	423
37. Mud rings	247	232	166	318	445	636
38. Packing nuts	491	419	402	523	828	991
39. Packing, piston rod and valve stem......	833	592	444	706	1,429	1,708
40. Pilots and pilot beams.	174	123	145	160	272	371
41. Plugs and studs	242	151	176	182	348	482
42. Reversing gear	390	254	202	299	579	788
43. Rods, main and side, crank pins, and collars	1,670	1,327	1,256	1,520	2,488	3,465
44. Safety valves	103	53	63	61	116	170
45. Sanders	697	376	289	314	804	1,008
46. Springs and spring rigging	2,854	2,122	1,851	2,161	3,311	4,557
47. Squirt hose	107	93	96	184	313	387
48. Stay bolts	285	219	181	293	395	542
49. Stay bolts, broken....	455	368	552	938	1,098	1,197
50. Steam pipes	489	338	285	512	730	925
51. Steam valves	267	193	143	226	399	471
52. Steps	567	498	622	676	1,021	1,394
53. Tanks and tank valves	862	600	587	732	1,426	1,717
54. Telltale holes	93	90	108	151	183	174
55. Throttles and throttle rigging	639	448	434	574	1,175	1,554
56. Trucks, engine and trailing	898	664	648	714	1,141	1,605
57. Trucks, tender	918	747	766	1,059	1,531	2,114
58. Valve motion	784	640	520	497	827	1,067
59. Washout plugs	776	623	599	815	1,283	1,871
60. Train-control equipment	8	4	13	9	48	60
61. Water glasses, fittings and shields	907	716	676	955	1,501	1,816
62. Wheels	734	580	603	750	1,025	1,325
63. Miscellaneous — signal appliances, badge plates, brakes (hand)	572	423	325	418	691	1,101
Total number of defects	43,271	32,733	27,832	36,968	60,292	77,268
Locomotives reported	54,283	56,971	59,110	60,841	61,947	63,562
Locomotives inspected ...	89,716	87,658	96,924	101,224	100,794	96,465
Locomotives defective	10,713	8,388	7,724	10,277	16,300	20,185
Percentage of inspected found defective ...	12	10	8	10	16	21
Locomotives ordered out of service	754	544	527	688	1,200	1,490



Front end of main rod failed because of application of bronze by fusion welding to take up lateral play

previous year and 8 per cent in the year ended June 30, 1932. The increase in the percentage found defective was brought about by the railroads drastically curtailing their maintenance forces and, in general, performing only such work as appeared to be immediately necessary. The effect of this policy was to produce a considerably greater recession in the condition of locomotives over the two-year period and especially for the year just passed, than is indicated by the increase in the percentage found defective because of the accumulated wear of major parts which would otherwise have been restored currently. There was an increase of 38.6 per cent in the number of locomotives ordered withheld from service because of defects that rendered them immediately unsafe as compared with the previous year, an increase of 31.3 per cent in the total number of defects found, and increases in individual items found defective ranging from 3 per cent to 149 per cent. A comparison of the number of defects found over a six-year period is shown in one of the tables, from which it will be noted that the increase in the number of defects is

Leaking tank hose "repaired" at enginehouse

Turret-valve bonnet which blew out due to defective threads while engine was being prepared for first service after a Class 3 repairs

represented largely by items that require heavy repairs to restore the deferred maintenance.

Boiler Explosions or Crown-Sheet Failures

Boiler explosions or crown-sheet failure continue to be the most prolific source of fatal accidents. There was an increase of two accidents, an increase of two in the number of persons killed, and of 15 in the number injured from this cause, as compared with the previous year. There was, however, compared with the fiscal year ended June 30, 1912—the first year the Boiler Inspection Act was operative—a reduction of 92.6 per cent in the number of accidents, a reduction of 94.8 per cent in the number of persons killed, and a reduction of 89.9 per cent in the number of persons injured.

Extension of Time for Removal of Flues

A total of 1,674 applications were filed for extensions of time for removal of flues, as provided in Rule 10. Investigations disclosed that in 140 of these cases the condition of the locomotives was such that extensions could not be granted. One hundred sixty-five were in such condition that full extensions requested could not be authorized, but extensions for shorter periods were allowed. Extensions were granted in 189 cases after defects disclosed by investigations were repaired. Fifty applications were canceled for various reasons. Applications totaling 1,130 were granted for the full periods requested.

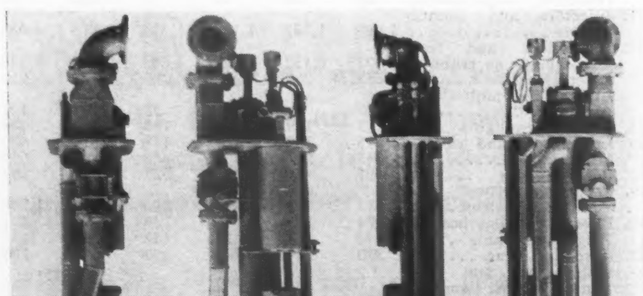
Specification Cards and Reports

Under Rule 54 for Inspection and Testing of Steam Locomotives 120 specification cards and 3,655 alteration reports were filed, checked and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found. Under Rules 328 and 329 for Inspection and Testing of Locomotives Other than Steam 37 specifications and eight alteration reports were filed for locomotive units and three specifications and 25 alteration reports for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found. No formal appeal by any carrier was taken from the decisions of any inspector during the year.

Holes in roof sheet were cut too large and then plugged up by poor fusion welding—Most plugs fell out when the sheet was straightened for use as a template

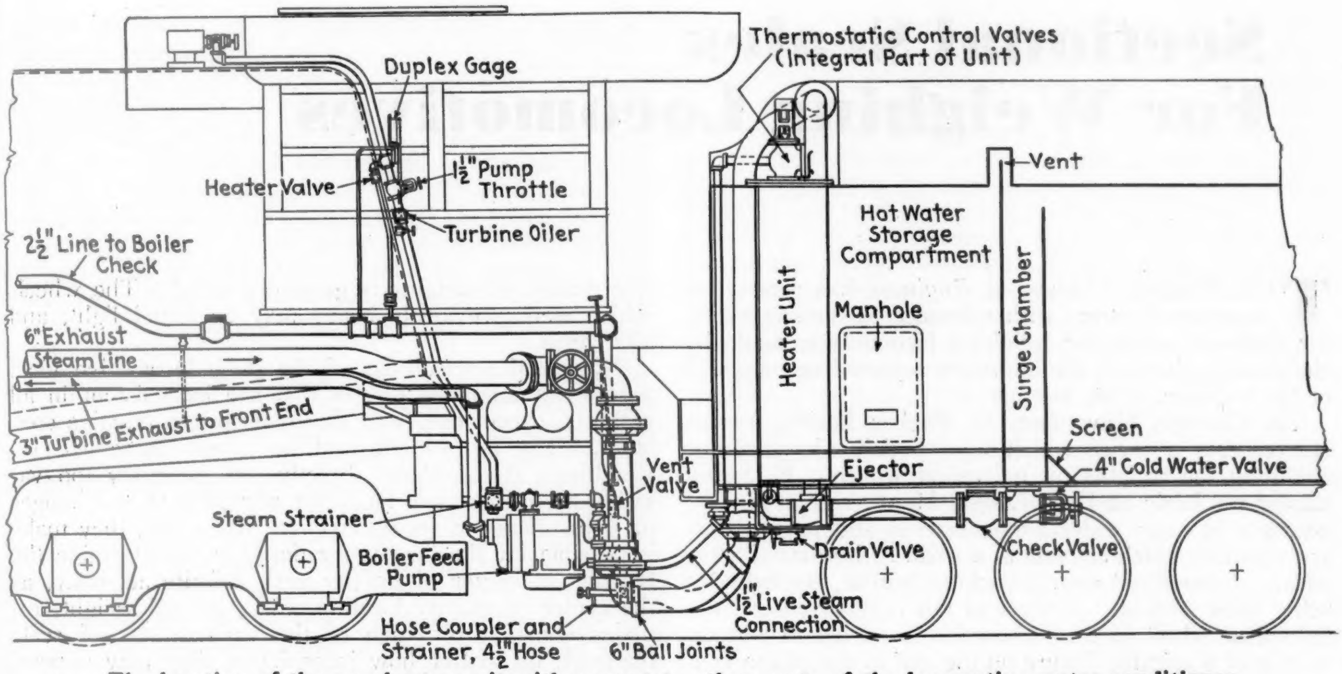
Locomotive Water Conditioner Improved

The equipment for heating boiler feedwater, made by the Wilson Engineering Corporation, Chicago, and known as the Locomotive Water Conditioner, has recently been improved in the interests of simplicity, low cost of installation and reliability. The Locomotive Water Conditioner, as described in an article beginning on page 132 of the *Railway Age* issue of December 20, 1930, provides for storage of water heated by exhaust steam in a compartment of the locomotive tender tank. This water is maintained at a predetermined temperature, available for use in the locomotive boiler at all times, whether the locomotive is working, drifting, or standing. The apparatus necessary to maintain a predetermined level of water in the hot well, as well as predetermined temperature, is relatively simple in construction. It consists of an exhaust-steam ejector, or syphon, for lifting the water from the varying level of the main tank to the constant level required in the hot well; a gravity flow valve, to permit of first filling the hot well; a system of exhaust-steam combining nozzles; exhaust-steam and live-steam thermostatically controlled valves to maintain the predetermined temperature under all conditions, and vacuum relief valves.



Four views of the composite tank unit which comprises a compact design easily installed

Formerly, the detailed equipment mentioned was furnished in separate units for assembly in the engine-tank compartment. Recognizing the advantages, including reduced installation cost, in having all parts as-



The location of the new heater unit with respect to other parts of the locomotive water conditioner

sembled into a single unit, such a design was perfected, fabricated, and placed in service with results which are said to be satisfactory. It is a part of the equipment of five of the new Northern Pacific locomotives, now being built at the Eddystone plant of the Baldwin Locomotive Works.

From four views of this composite tank unit, shown in a single illustration, it will be noted that only steam and water connections remain to be made after this unit has been installed in the tender tank. The top connection takes the 6-in. exhaust-steam return line to a header, which distributes the steam between the ejector, or syphon, and thermostatically controlled heater nozzles. Between the header and the ejector, a sturdy float valve assembly is interposed. It will be noted that the float arm is counterbalanced and that the float is protectively boxed. The same is true of the secondary float assembly controlling the gravity feed valve.

From the header mentioned, steam is by-passed to the heater nozzles through a 4-in. thermostatic control valve. It will be noted that the bulbs for these valves are solidly built into the assembly unit to prevent injury from vibration or displacement.

In normal operation, only the 4-in. thermostatic valve and the ejector float-control valve are called upon to function. The secondary thermostatic control valve governs the admission of live steam for preliminary heating as the locomotive leaves the terminal. Its range has a top limit of 140 deg. F., whereas the main thermostatic valve is set normally at 208 deg. F. This arrangement prevents the use of live steam at all times while the locomotive is working.

The gravity feed valve, with its float control, operates only to permit filling the hot well after the main tank and storage compartments have been completely emptied and the main tank refilled, either in terminals or at water stations.

Referring to the drawing, a typical installation is shown, including the main exhaust-steam return line, with flexible engine-tank connection, the turbine-driven centrifugal hot-water boiler feed pump, and the simple cab piping. The tender tank assembled unit, developed as described by the Wilson Engineering Corporation, is fabricated by the Taylor Forge & Pipe Works, Chicago.

Special details of equipment required in connection with the Locomotive Water Conditioner are as follows: Exhaust steam butterfly valve, Crane Company; stainless steel floats, Arthur Harris & Co.; thermostatic control valves, Fulton Syphon Company; duplex gage, Consolidated Ashcroft Hancock Company; two-stage axial-flow turbine, Pyle-National Company; two-stage, double-suction-impeller centrifugal pump, Allis-Chalmers Manufacturing Company; six-inch joints in engine-tender connection, Barco Manufacturing Company.

* * *

Further explanation furnished by the Editor upon request

Sectional Scales For Weighing Locomotives

THE *Railway Mechanical Engineer* has received a number of letters with reference to the suggestion for sectional scales for weighing locomotives, made by the chief engineer in the interview reported on page 356 of the October, 1934, number.

The Chicago, Milwaukee, St. Paul & Pacific, for instance, uses a device which was specially designed for obtaining the weights on individual wheels. E. Sears, master mechanic at Deer Lodge, Mont., recognized the necessity of such scales and contrived and patented an arrangement which consists of a small hydraulic cylinder, with a piston fitted with a packing leather, the cylinder being filled with oil. A piece of rail is removed and the individual wheel of the locomotive is moved to rest on the top of a suitable fixture on the end of the piston rod. A gage, properly calibrated, indicates the weight in pounds. A number of these scales are being used with satisfactory results.

Not in Entire Accord with Chief Engineer

A mechanical officer of another railroad concurs "in the suggestion of the chief engineer, with certain rather important and extensive reservations." "We believe," he says, "that some accurate means of determining the total weight and the location of the center of gravity of a locomotive should be available to the motive power engineering office of each railroad that designs new, or rebuilds old locomotives, or attempts to design or modify locomotive springs, equalizers and other parts of the carrying gear. Without such facilities, the engineering forces are in the dark when trying to carry on work of this kind.

"Individual locomotive scales afford the best means that we know of for determining the location of the center of gravity of a locomotive, but their actual value for other purposes is questionable. The summation of weights read from individual scales will, of course, give the total weight of the locomotive with a reasonable degree of accuracy, but this total weight can be more accurately obtained by placing the locomotive on a suitable platform or track scale. At best, the accuracy of individual locomotive scales under loads of 27,000 to 32,000 lb. is about plus or minus 25 lb. Hence, the cumulative error in total weight of the locomotive obtained by adding the readings of individual scales will depend upon the number of scales used and the extent to which plus or minus errors predominate. A well designed track scale is accurate within a tolerance of plus or minus 20 lb. for any reading within its capacity.

"We would not recommend placing individual locomotive scales indiscriminately at the disposal of shop or road men to use as a guide in adjusting the equalizers and spring rigging of locomotives. Any attempt to do this would result in confusion, with probability of serious consequences. Each locomotive has a certain definite weight at rail under each wheel, but it seldom happens that these weights are indicated by the readings of individual scales when the locomotive is first placed upon them. Some wheels will weigh more than they should, and others less. If the locomotive is taken off the scales, moved about and reweighed, a radical change in the distribution of weights is generally noted. The wheels which were previously heavy may be found light, and vice versa.

"Repeated reweighings of the same locomotive yield a series of tabulated figures that are inconsistent in all respects, except one, viz., the total weight remains constant. The figures obtained by a few successive reweighings, if considered directly, are generally too variable to form a safe basis for any idea as to changes or adjustments in spring rigging. However, they make it possible for the locomotive designer to determine the location of center of gravity with definite accuracy, as the center of gravity location, like the total weight, remains constant for each of the various sets of scale readings, no matter how inconsistent they may appear. The location of center of gravity, along with the various individual spring and rail-borne weights, enables the designer to calculate the weight at rail under each pair of wheels.

The results of a large number of successive reweighings, if averaged, will agree fairly well with the calculated weights, and by jarring springs, equalizers, etc., with rams or sledges while the locomotive is standing on the scales, weights agreeing fairly well with the calculated weights may be obtained. Even better results may be obtained with less work by slightly lowering the heavy wheels and raising the light ones. Hence it will be seen that by intelligent manipulation of the locomotive carrying gear or the scales, scale readings which agree with the theoretically correct weights can be obtained, but such agreement is practically never found in any single set of random scale readings.

"The reason for this is to be found in the design of the locomotive, rather than in the design or construction of scales, or in the individual scale system of weighing locomotives. The springs and equalizers of a locomotive form a system of levers which, in the absence of friction, would distribute the weight of the locomotive with mathematical accuracy among the various pairs of wheels, according to the ratios of the various lever arms. Unfortunately, however, the bearings of all moving parts of locomotive carrying gear are designed primarily to minimize wear over long periods, rather than to avoid friction; consequently the movements of all parts are seriously impeded by friction. This applies alike to the bearings of equalizer fulcrums, spring hanger pins, shoes and wedges, etc., and heavy variations in weight at rail are required to cause these parts to move or slide on their bearings.

"Individual locomotive scales are instruments to be used by the mechanical engineer, rather than as a practical shop tool. One set of individual locomotive scales located at the designing headquarters of each railway that can afford them would be very desirable, but such scales, if used as a piece of ordinary shop equipment, would, in our opinion, prove to be expensive and unnecessary, if not decidedly undesirable."

Another Scheme for Obtaining Weights

Several letters suggest ways and means of securing the weights on different pairs of drivers, by manipulat-

ing the locomotive on the platform scale. Typical of this is the following:

To the Editor:

Your editorial comment on the importance of sectional scale weighing of locomotives in the November issue, and the communication of William T. Hoecker in the same number, are very much to the point.

The distribution of weight on driving wheels, engine trucks and trailers is too much taken for granted on the basis of specification figures and is generally disregarded entirely in roundhouses when changing wheels, spring rigging and tires.

It has been my experience with 4-4-2 and 4-6-2 type locomotives that their hard riding and poor traction are generally due to poor weight distribution. The tendency is to get excess weight on the engine trucks and trailers by maintaining nearly full size wheels in them regardless of the thickness of driving tires. The results are a slippery engine, severe jolts in the cab, and a nosing or snaking motion, especially when running at high speed.

In the absence of sectional scales I have found that good results can be obtained by weighing the engine in sections on standard weigh scales in the following manner:

The engine should have boiler filled, if not moved under its own steam; then first place the engine truck on the scale, being careful to first get the central point between the rear engine truck wheel and first driving wheel, and have it directly over the end of the scale table when the weight is taken. Follow the same method when weighing the first drivers. Then subtract from it the weight of engine truck, and the answer will be the weight on the first drivers. Follow through in the same manner to the second and third drivers; and if the capacity of the scales will not permit weighing the entire engine in that way, deduct the sum of the several weights taken from the known total weight of the engine, and the difference will be the weight on trailers. By this method weight distribution can be adjusted with reasonable accuracy. C. Raitt.

Reid Steam-Pipe Casing

The purpose of the Reid steam-pipe casing designed by the Lima Locomotive Works, Inc., is to prevent the admission of air to the smokebox through the opening around the steam pipe and, in doing this, to provide ample flexibility, thus obviating any tendency for the casing to pull away from its connections.

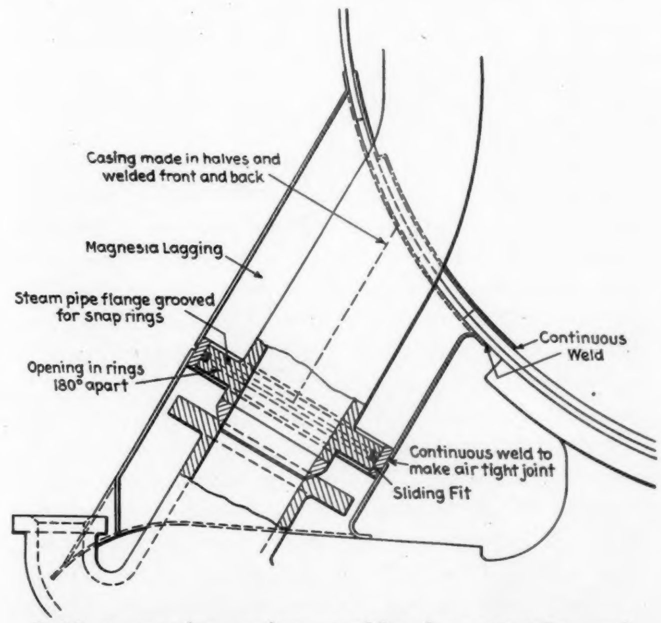
Referring to the illustration, it will be noted that the opening in the smokebox around the steam pipe is closed by a plate liner which fits closely around the pipe and is welded continuously around its outside edge to the inner face of the smokebox shell.

Cylindrical casings encompass the steam pipe. One of these casings extends from the smokebox to a point adjacent the steam-pipe flange. The upper end of this casing is flanged and welded to the outer face of the smokebox shell, while the lower end is welded to a steel casing ring. This ring encircles the steam-pipe flange and is bored just sufficiently larger than the finished flange to secure a sliding fit over it. A groove is formed around the steam pipe flange to receive two snap rings. These snap rings, with joints spaced 180 deg. apart, expand outwardly against the casing ring, thus effectively establishing an air-tight joint. Within this casing the steam pipe may be lagged with magnesia or other heat-resistant material to lessen the radiation of heat from the steam pipe. As will be noted from the illustration, the casing is made in halves and welded on the front and back sides to facilitate application.

A lower section of casing is also provided. This portion of the casing extends from the steam-pipe flange casing ring to the valve chest on the cylinder.

From this description it will be seen that, in addition to an air-tight closure for the smokebox, a positive means is provided for taking care of expansion and contraction as well as vibration of the locomotive. This is accomplished through the casing ring, the inside face of which is arranged to slide freely on the steam-pipe flange.

While the illustration shows the flange of the steam pipe as designed to suit application of this casing, on engines already built where the steam-pipe flange is not similarly formed it is usually possible by a slight modification in the arrangement to use the existing steam pipes.



Reid steam pipe casing provides for expansion and assures freedom from air leakage to smoke box

Patent applications are now pending on the Reid steam-pipe casing arrangement which was used on the Pacific type locomotives recently built by the Lima Locomotive Works, Inc., for the Boston & Maine.

* * *

World's Slowest Train.—With all the excitement about fast runs, both passenger and freight, may we call attention to the opposite side of the picture—a train which by comparison makes the once well-known "Slow Train in Arkansas" a speedster of the first rank. The world's slowest train is believed to be the "tea and sugar special" which carries supplies from Port August, Australia, to Kalgoorlie and way points. Under its not too pressing schedule the train takes a week to travel the 1,051 miles and another week to make the return trip. More remarkable than the train's snail-like pace is the fact that it sometimes carries passengers!

EDITORIALS

Speed, Weight And Horsepower

The records for long-distance high-speed runs which the new light, self-propelled articulated trains have made during the past year have focused the attention of the public and of railway managements alike on faster passenger-train schedules. Having been given form by these new trains, popular ideas concerning future development are all built around the use of equipment of the self-propelled, articulated type. Consideration of the conditions required for high speeds, however, clearly indicate that the development of fast schedules is by no means confined to this new type, or, indeed, to any particular type, whether it be self-propelled or locomotive hauled.

The top speed at which a train may be hauled and the schedule it can maintain under any given set of conditions depends more directly on the horsepower actually available per ton of train weight than upon any other single factor. It is primarily because their proportions are favorable in this respect that the new self-propelled articulated trains are adapted for fast schedules and high top speeds. The first Union Pacific articulated train and the Burlington Zephyr are provided with approximately five rated horsepower per ton of train weight. When the fourth body section, now on order, is placed in the Burlington Zephyr it will still have about four rated horsepower per ton. The second Union Pacific articulated train, with its six body sections and 900 hp. engine rating, is provided with about 4.3 hp. per ton. In contrast with this, on lines where the traffic is heavy many passenger trains are maintaining conventional schedules with not more than 2.75 hp. per ton of total weight, including that of the steam locomotive. It is due to no inherent lack of ability of the steam locomotive to meet fast schedules that such trains move on overall schedules which are usually less than 50 miles an hour.

The growth in weight of passenger trains, both from an increase in average weight of passenger-train cars, as well as from an increase in the number of cars per train, during a period in which motive-power developments have stood still on many roads, is a tribute to the flexibility of the steam locomotive and even more to the reserve capacity which can be drawn upon to meet overloads. Many locomotives now loaded to a ratio of 2.5 to 2.75 provided from 3.25 to 3.5 hp. per ton of the trains they were commonly called upon to move when they were built.

While by no means all existing passenger locomotives are designed for high top speeds or generally fast schedules, there are many in service today for which top speeds of 90 to 100 miles an hour are not uncommon. Properly loaded for schedules calling for such speeds, the steam locomotive itself places no barrier to their regular maintenance.

The Importance of Weight Reduction

In approaching the question of faster passenger-train schedules, then, the new light-weight articulated trains have taught us that the first consideration is one of reducing train weights. The only alternative is to increase locomotive capacity. To provide trains of twelve 80-ton passenger-train cars, weighing 960 tons, with a locomotive capable of furnishing four horsepower per ton of locomotive and train, would require about 5,500 hp. if the locomotive and tender weighed no more than 150 lb. per horsepower and the combined weight would be about 1,370 tons—not an attractive alternative to weight reduction.

Of course, weight can be reduced by shortening trains. This may offer a practicable solution in certain cases, but if faster schedules become popular where they are put into effect, it is only a question of time until most of the service where the saved time can be used by the patron to advantage will have to be brought up to the expedited schedules. It is reasonable, therefore, to expect weight reduction to become an important consideration in all passenger-car construction of the future.

Built-In vs. Separate Power Plants

The light, articulated trains represent a combination of light weight and self-propulsion by a Diesel-electric power plant, small in comparison with the steam locomotive capacity which would be required for fast service with equivalent facilities in conventional rolling stock, but large in relation to the weight of its train. For small trains requiring 600 to 900 hp. the advantage of this arrangement is unquestioned. The separate locomotive, either Diesel-electric or steam, and especially the latter with its tender, would constitute a heavy extra burden of weight, which would, in turn, increase the horsepower needed if the same horsepower-weight ratio were to be maintained. It should be noted, however, that the advantage of self-propulsion is rapidly lost as the length of train increases and that the Diesel-electric power plants are a larger proportion of the total weight of the articulated trains than is the

steam locomotive, with its tender, at the head end of a heavy train of conventional rolling stock.

The power plant of the Zephyr complete, including the prime mover, generator, motors, motor truck, heating plant and that part of the train structure required to house it, weighs not less than 50 tons, probably a little more—165 lb. per horsepower—and represents a little more than 40 per cent of the total weight of the train. For the six-section Union Pacific train the power plant and its vehicle probably weigh in excess of 80 tons—about 180 lb. per horsepower—and account for about 39 per cent of the total train weight. Indeed, in this train the power plant, filling completely one body section and utilizing two trucks for traction, could, except for the restraint of the articulation, be used as a locomotive.

There are many main-line steam passenger locomotives which do not exceed 175 lb. of locomotive and tender per horsepower and some high-capacity units which weigh as little as 150 lb. per horsepower. When hauling 10 to 12 passenger cars, depending on the car weights, these main-line locomotives constitute from 23 to 30 per cent of the train weight.

It is evident, then, that as trains become larger and heavier the advantage of the built-in power plant over the separate locomotive, whether steam or Diesel-electric, rapidly disappears. The advantages of flexibility weigh heavily in favor of the separate power plant and there would seem to be little advantage in built-in units beyond 900-hp. capacity so far as weight is concerned.

Streamlining

In this discussion nothing has been said about streamlining in its relation to horsepower and speed. There can be no question as to the effectiveness of proper front and rear end formation and smoothness of longitudinal surfaces in largely reducing air resistance. Before air resistance becomes a sufficiently large part of the total resistance to be an important factor in determining motive-power capacity and fuel economy, however, operating speeds must not only be in the range above 60 m.p.h., but also must be sustained well up in that range for a considerable part of the running time. Furthermore, with heavy, conventional rolling stock the advantages are relatively less than with the light-weight equipment. The air resistance of the light-weight, streamlined articulated trains, at say 90 miles an hour, represents about half the total resistance. For a six-car conventional train with a locomotive at the same speed it will constitute slightly less than half of the total resistance.

The important factor in making high speeds possible and, even more so, in making faster schedules possible without resorting to extremely high top speeds, is a reasonable ratio of horsepower to total weight of train. Streamlining assists in raising the top speed and to some extent increases acceleration at high speeds. Weight reduction increases acceleration at low as well as at high speeds.

Shop Crafts Labor Union Problems

The *Railway Mechanical Engineer* holds no brief, either for or against the shop crafts labor unions. To the extent that these unions and their leaders represent and protect the best interests of the workers, well and good. The workers' interests, however, are dependent upon a healthy and prosperous employer—an employer, which, if it is to remain solvent and survive, must give good service to the public at reasonable rates as compared to competitors, and must at the same time pay a reasonable return to the investors who have put their money in the enterprise.

Mistakes Have Been Made

The railroads cannot play Santa Claus to everybody; their resources are limited, in spite of the vaporings of the demagogs and leaders who lack any understanding of sound economics. This must be evident to anybody that has any real understanding of the railroad situation of today. A favorite device of the demagogs, when cornered, is to refer back to the "railroad barons" and abuses of the past. These were wrong doings, and no honest person will attempt to excuse them, but the early investors in most cases paid the penalty long ago—in many instances losing their all.

The railroads have been under close government supervision and regulation for several decades—and, incidentally, it is now evident that the legislators and regulators have been guilty of at least as much short-sightedness and lack of ability in this period as any of the railroad builders and managers. Indeed, they have been less efficient, for on the whole they have approached their tasks in most cases with a lamentable ignorance of railroading and have groped their way about as best they could; this in many instances appears almost pathetic, as we study the results and the reaction upon the public welfare. Only a country rich in natural resources, and in a pioneering state, could have come through this bungling without more serious disasters.

The Public Waking Up

The fact seems to be slowly percolating into the American consciousness that something has been very wrong with the treatment accorded the railways. The public is realizing, even if hazily, that its interests and those of the railroad employees and the railroad investors are mutual, and that the rights of each must be jealously safeguarded and balanced against the others.

The day of the railroad as a monopoly has passed. At best it will remain the backbone of transportation in this country, but it must be prepared to face bitter and relentless competition on all sides. If it cannot furnish good service at reasonable rates compared to its competitors it will lose the business, and may have to go into the scrap heap. The record of abandoned

railroad mileage in the last decade is not pleasant to contemplate.

Railroad Employees on the Job

Many railroad employees, seeing business drifting to subsidized competitors on the highway, the waterway, and in the air, have organized to protect the interests of the railways, realizing full well that their jobs are in jeopardy. The railroad labor unions, however, as such, have unfortunately shown little aggressive interest in helping the railroads in their efforts to secure a fair and square deal, and to survive. This seems more than passing strange, for surely nothing could be of greater importance to the welfare of their members.

Not only have the unions refrained from fighting for the railroads, but in some instances they have sponsored candidates for legislative positions who have been notable for giving railroads a raw deal. Moreover, in spite of the fact that more business for the railroads would give more work to more men, they have insisted upon legislation which has tied the hands of the railroads in consolidating some of their facilities in the effort to eliminate waste, and thus render the same or better service at lower cost. By these and other actions they have apparently—we believe through ignorance, and not purposely—been killing the goose that "lays the golden eggs"; in other words, forcing their employers into curtailing service and facilities, and abandoning many lines, with resultant reductions in the number of available jobs. They insisted and forced the Administration to put wages back on a pre-depression basis, in spite of the fact that millions of men and women in this country have no jobs at all, and few workers, except in favored industries, have been restored to former wage and salary scales. They insisted on a retirement or pension bill which contained extravagant provisions and which, even under normal conditions, would be financially unsound.

What Will the Labor Leaders Do?

Railroad managements have their faults, and plenty of them. What group has not? Surely the labor leaders are no exception to the rule. Will these leaders profit from past experiences and control their organizations with real statesmanship, or will they lose their heads, now that they are apparently in the ascendancy, and again suffer serious consequences when the reaction comes—and it surely will, if they go to extremes.

Consider, for instance, the railroad shop crafts. More than any other railroad employees' group they have had their ups and downs in the past. The experiences during the last two decades are still fresh in our minds. Not any too strong twenty years ago, they grew like mushrooms under McAdoo and the Railroad Administration. Flushed with power after developing extravagant and ridiculous rules and working agreements, they went beyond all reasonable limits, with the resulting disastrous shop crafts strike of 1922; indeed, they were almost wiped out of existence. Employee representation was introduced on most roads, although apparently in only a few cases were its principles rightly understood and applied.

In an effort to stage a comeback, the shop crafts sponsored the labor union-management co-operative plan on the Baltimore & Ohio and the Canadian National. This was extended in a modified form to a few other roads, but when the depression came the shop crafts labor unions were in a weakened state and were having difficulty in surviving. The Emergency Transportation Act gave them a new lease of life, and judging from the lurid headlines in "Labor," the shop craft labor unions are now "riding high and wide." "Shop Crafts Still Moving Forwards," reads a headline in a recent issue. The subtitle reads, "End of Year Sees A. F. of L. Railway Department Unions Making Big Gains."

The labor organizations and their leaders have a real opportunity for statesmanlike strategy which comes but once in a generation. Will they take advantage of it? Only time can tell. If they go beyond reasonable limits in fighting for their immediate selfish ends, if they forget that their interests and those of the public and investor are mutual, then history may repeat itself, and after great damage to all concerned, conditions may again be reversed and they may go back to 1914 or 1930. Let us hope that the experiences of the past two decades will not be lost and that real and understanding leadership on both sides of the problem—managerial and employee—will build for sounder and better relations, with mutual benefit to all concerned.

NEW BOOKS

FREIGHT TRAIN RESISTANCE, ITS RELATION TO AVERAGE CAR WEIGHT. *By Edward C. Schmidt, professor of railway engineering. Reprinted by the Engineering Experiment Station, University of Illinois, Urbana, Ill. Bulletin No. 43; 86 pages; paper bound. Price, 90 cents.*

Bulletin No. 43 was first published in May, 1910. It covered a series of dynamometer-car road tests begun in April, 1908, and concluded about a year later. These tests were planned to determine the resistance of freight trains under usual operating conditions and to disclose the relation existing at any given speed between train resistance and average car weight. The results are the foundation on which adjusted locomotive ratings have since been developed. The reprint contains all the original material of use in a study of train resistance and tonnage ratings, including full discussions of calculation methods and resistance-speed curves for each of the individual tests made. This bulletin, which until now has long been out of print, still remains the basis for the information published in most handbooks and text on the resistance of railway freight cars.

THE READER'S PAGE

Leadership First—Specialized Training Second?

TO THE EDITOR:

In the letter, entitled "Two Sides to This," on page 370, of the October issue of the *Railway Mechanical Engineer,* W. H. Shiver has not carried his reasoning far enough.

Point 1—A man has freight-car experience before being promoted to a coach carpenter, also usually if he wasn't a little above the average he would not have qualified himself as a coach carpenter.

Point 2—The officer making the appointment picks the one he thinks is the best man, as his success depends to a great extent on the ability of his subordinates. I would say if he picked the wrong man in this particular case there is apt to be something wrong with Mr. Shiver's personal salesmanship rather than a case of poor judgment by the "big boss," unless, of course, the big boss *did* pick the right man.

I am working under a car foreman promoted from the coach yard and he is doing splendidly at handling a very difficult job. In the final analysis it is the man's ability and not how much freight-car yard experience he has had. His ability as a leader is much more important than his knowledge of the A. R. A. rules which is, of course, important also.

G. M. MIDDLETON
Car Repairer

The Problem of Reverse Gear Creep Must Be Solved

TO THE EDITOR:

A re-reading of your editorial "The Cost of Creeping Gears" in the September *Railway Mechanical Engineer* leads me to venture a few comments on this important subject.

In spite of its defects, among which creeping is the most flagrant source of inefficiency and expense, the power reverse gear is an indispensable part of the equipment of modern locomotives. As a means of reducing manual labor and enabling enginemen to make cut-off adjustments at running speeds in accord with the demands of economy and efficiency, the power gear is an absolute necessity. The failure of gears to hold cut-offs precisely in step with the enginemen's desires will continue to be a live subject until some positive means of establishing and of definitely maintaining desirable cut-offs has been developed and placed in general service.

Especially in the case of larger locomotives, now mostly stoker-fired, the manual ease with which cut-off adjustments may be made with the power reverse gear, the consequent saving of time, particularly in the switching service, etc., are unquestioned, but these advantages have been royally paid for in wasted fuel and heavy gear maintenance expense. Many gears, reported creeping, are dismantled and reassembled again without correcting the difficulty. Then we must add steam and fuel losses due to the unavoidable use of restricted throttle openings in combination with cut-offs longer than those most efficient. This practice affords enginemen some relief from the annoyances of creep but at the expense of adversely affected cylinder expansion performance and inefficient firebox conditions due to creep-produced variations in the exhaust and draft.

An unfortunate aspect of the situation lies in the fact that any live interest on the part of the enginemen and firemen in the exercise of effort to perform their work neatly is discouraged rather than encouraged. Carelessness is invited. The engineman is powerless to do more than minimize distracting variations in the sound of the exhaust and annoying effects following by lengthening the cut-off and correspondingly partially closing the throttle. Having done this, he must dismiss the subject since there is nothing left for him to do other than perhaps to report the gear's creeping at the end of the run.

How about the fireman who is frequently overlooked in considerations of the matter? What happens with him? Assume some instant while running along at speed when the gear has crept in the direction of the center, when the cut-offs obtained are correspondingly short and when the exhaust and the draft are light. Assume that the fireman has managed the arrangement of a "nice" thin fire efficiently corresponding to these conditions. Everything is going well but, sooner or later, dependent upon how rapidly the creep cycles happen to be repeating themselves, the gear will creep ahead into longer cut-offs causing heavier exhausts and a stronger draft for which the thin light fire is entirely unsuited. The fire is more or less seriously damaged and, after the damage is done, the fireman must busy himself with the battle involved in building up a heavier fire which the new conditions demand. Then, having gotten the fire into shape corresponding to the heavier draft now imposed upon it, he soon finds the gear to have crept toward the center again where the lightened draft is again insufficient to keep the fire efficiently alive.

The result is that the most interested, well-informed fireman cannot keep step with the changes referred to and is dragged into the general practice of simply doing the best he can by attempting to hold to some intermediate fair average fire which is never right or exactly satisfying. The adverse contribution which all this makes toward the obstruction of flues with unburned fuel and ash is obvious. The imposition of a heavy draft upon a light fire is the direct means of producing or aggravating honeycomb. And how about the losses at the stack from which is made to pass unburned or incompletely burned fuel? Under the conditions cited, how can the crew maintain a desirable uniformity in water level and pressure when invited or forced to continually swap water for steam or vice versa?

I have touched only the high spots. To these, many others should be added, such as the cost of water unnecessarily consumed, ashes unnecessarily produced, various locomotive "failures," failures to make schedule, etc., and it appears to me that information which should serve to stimulate effort toward the elimination of fundamental reverse-gear difficulty should be collected and studied with renewed energy.

Concluding, I beg to suggest that power-reverse-gear troubles, though expensive, are largely hidden and unnoticed. However, like the poor, they are always with us. To the engineman, the power gear is indispensable.

He is for the extension of relief from the back-breaking Johnson bar by the application of power gear to all locomotives of any size. He does not wish to discourage such further extension. His work reports are largely relied upon as an indicator of gear conditions and he knows it. In view of these facts, can he be expected to report each observation of repeated fault or reason for complaint? I fear not.

The power reverse gear trouble which you have brought to light is important and railway officers above the engineman and the master mechanic should take an interest in the matter which will assure its early cure. This means money.

SUPERVISOR OF LOCOMOTIVE PERFORMANCE.

Who Knows The Facts?

To THE EDITOR:

I am very curious to know just how a mule, even old "Missouri," could ever wreck a train by allowing it to strike any part of his anatomy, without injury to himself.

This brings to mind the story about the freight train that left Kansas City about 50 years ago with a full crew, and no part of train or crew was ever seen since. Would like to give more information about this, but the story came to me very incomplete and without authority. However, I am sure you can get the full details, as I understand the road on which this happened is still in operation.

J. P. HOWARD.

[Possibly some reader may be able to confirm the story about the missing freight train. The Editor will greatly appreciate receiving such information.]

"Missouri"—The Mule That Wrecked The Train

SPOKANE, WASH.

To THE EDITOR:

Your letter relative to one Missouri mule, causing derailment of a passenger train near Walla Walla, Wash., which was cartooned by "Marinac" and published in "Rail Oddities" in the November issue of the *Railway Mechanical Engineer*. The facts are as follows:

At 5:50 a.m., November 20, 1932, train No. 347, a three-car passenger train operating between Pasco and Walla Walla, a distance of 64 miles, consisting of engine 207, baggage car, coach and Pullman sleeper, was approaching Dry Creek siding, 9 miles east of Walla Walla, and running at a speed of approximately 25 miles per hour, weather clear and dark. When within a distance of 50 ft. from the east switch of the siding, Engineer A. K. Snyder observed a big mule running westward alongside of the track and close to the ends of ties in the same direction train was moving.

The said mule was running in violation of railway transportation rules; viz. "Classification" or "marker" signals were not displayed. Furthermore, being on the time of a first-class train, rear end protection as prescribed in Rule 99 was not afforded. Presumably, Missouri was trying to cover up, as "old rails" will do, by beating the train to the switch, take siding and dim his headlight—but in this he failed.

The forward portion of the engine, including the driving wheels and forward trucks of the tender, passed him, but in so doing it is believed the tank step of the engine contacted with the rear end of "Old Missouri" and boosted him forward against the switch stand, which was of high-banner type. The impact tore it loose from its fastenings and permitted the switch points to open between the trucks of the tender, derailing the rear truck and all cars in the train, which came to rest in a leaning position between the main track and siding, 175 ft. west of the switch stand.

No personal injuries occurred, although there were six passengers in the coach and four in the sleeper, and these cars were leaning at an angle of 45 deg. when train came to a stop.

When the wrecking outfit arrived at the scene of derailment several hours later, old Missouri was shamefacedly browsing on the right-of-way, his only disfigurement being a knot on the forehead and a small patch of hide missing in the region of his left rear marker bracket.

Total cost of damage amounted to $2,652.60; main line not clear for trains to pass until 5:50 p.m.

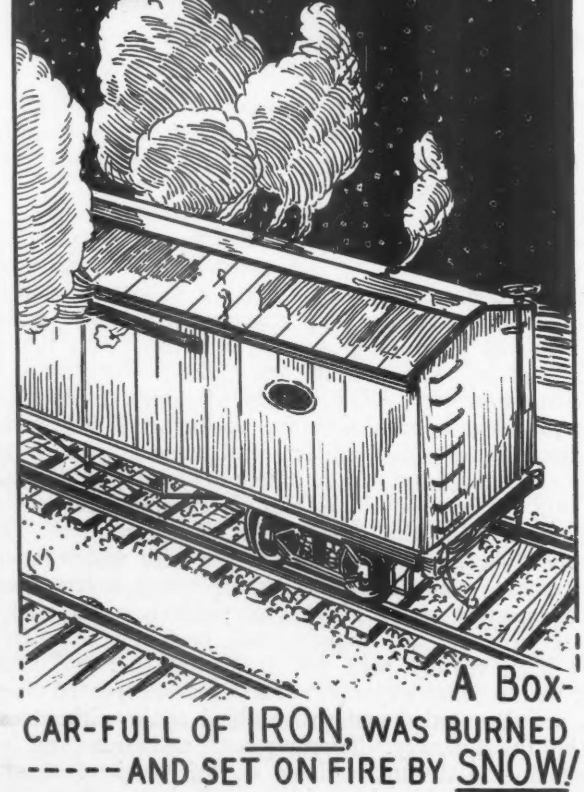
The owner of old Missouri was never determined and from last accounts he is still a derelict roaming through the sagebrush and hills. Undoubtedly his experience in this instance served to increase his respect for railway transportation rules, for he has not since encroached on the Northern Pacific right-of-way.

No disciplinary action taken.

(signed)—J. H. JOHNSON,
Superintendent, Northern Pacific.

[The caption used by the artist was not exactly correct. "Missouri" was hurt, but not badly.—EDITOR.]

* * *



Further explanation furnished by the editor upon request

With the
Car Foremen and Inspectors

Cars Inspected While Passing the Hump

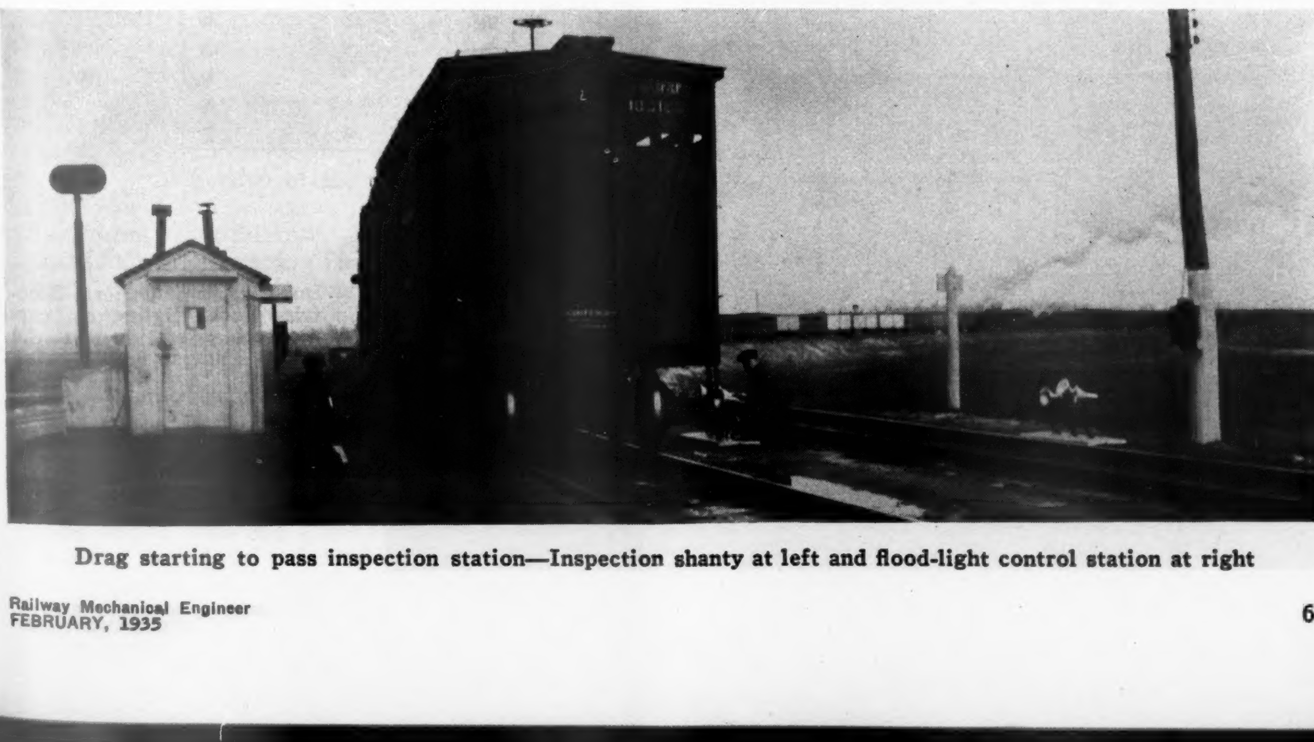
WITH a view to effecting savings in freight-train car inspection, as well as reducing train delays in terminal yards, the Chicago & North Western has recently installed an inspection station on the top of the classification hump at the Proviso yard, Proviso, Ill., where three shifts of two inspectors each make a running inspection of all cars which pass over the hump. The station is located on the receiving side of the hump about 550 ft. ahead of the cut-off point. In "humping" a train, the cars pass the station under a restricted speed of about 6 m.p.h. which permits detecting defects and automatically side carding bad-order cars, these cars then being classified and switched to the bad-order track, without delaying other cars. In addition to the saving in car inspection, it is estimated that this method of handling saves an average of 20 min. per train.

The limiting factor in a running inspection of this kind is proper visibility to permit seeing defects at night and at all other times when light conditions are poor. To meet this requirement at the Proviso hump, high-power flood lights are installed at the inspection station. These lights are said to enable cars to be inspected at night even more thoroughly and carefully than during the day, particularly if it happens to be a rather dark, stormy day. In addition to the flood lights, the station is provided with a 6-ft. by 20-ft. inspector's shanty where locker facilities are installed and inspectors are protected from the weather while waiting between trains.

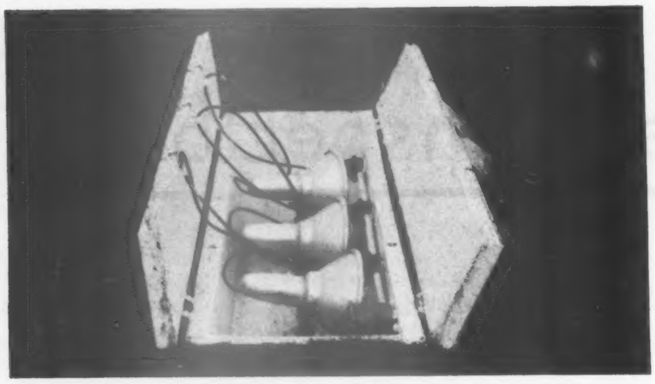
Previous to locating the inspection station on the Proviso hump, the incoming inspection was made in the receiving yard, involving some delay to trains waiting for the inspection to be completed. Naturally, these delays were greater at peak hours unless the situation was met by providing a large force of inspectors. Under the new arrangement, trains can be humped as fast as they arrive, waiting only for the air to be bled. Experience has shown that two inspectors, on each of three shifts on top of the hump, can handle this running inspection without difficulty and this number of men is adequate regardless of the number of trains classified over the hump.

The Proviso hump is equipped with two leads which are reduced to one just prior to the point where cars are dropped over the hump. Since the inspection point is located on the double lead, three banks of three lights each are required, one just outside of each track and one in the center between the tracks, this center bank of three lights being reversible so that it can be used in inspecting cars on whichever lead happens to be used at that particular time. The track centers of the two leads are spaced 13 ft. 9 in. and the outside lights 8 ft. 4 in. from the track centers. Each assembly or bank of lamps consists of three General Electric 200-Watt flood lights which are mounted on a telescopic arrangement permitting them to be lowered into a pit box during the day-time when they are not in use.

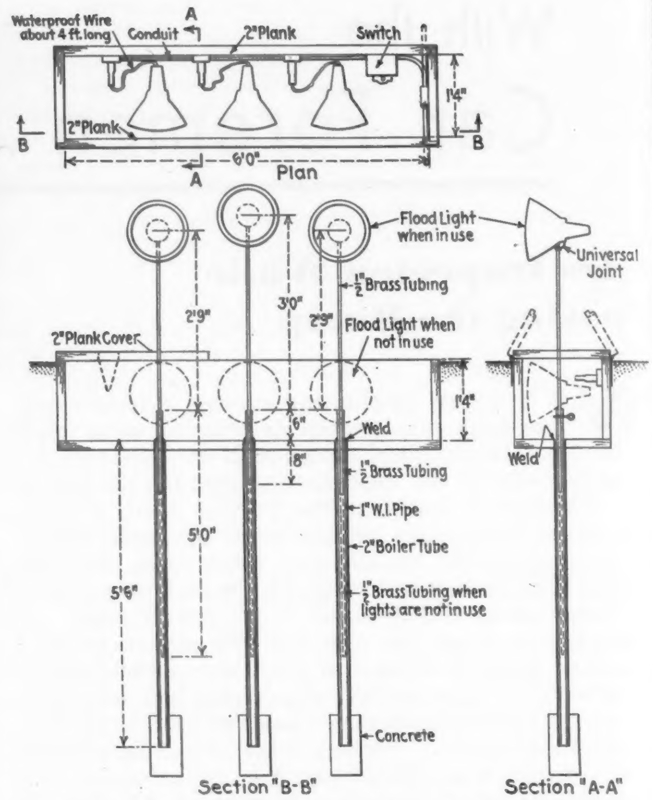
The telescopic arrangement, referred to, provides for dropping the lights into a pit box which is 16 in. wide by 16 in. deep by 6 ft. long, the lights being protected, when in the lowered position, by hinged covers on the box. This telescopic arrangement, shown in the illustration, is durable but not expensive to install. Three 2-in. boiler tubes, 5 ft. 6 in. long, are set in the ground, with the lower ends in concrete and the upper ends in the box mentioned. A 1-in. wrought iron pipe, 5 ft. long, is inserted in each tube to serve as the guide for a 4-ft. length of ½-in. brass tubing, on the upper end of which is mounted the lamp support and swivel. Each lamp is held in the upper position by means of the pin through the respective pieces of tubing. Only one adjustment of lamp height is provided, experiments having developed that the best results are secured with the



Drag starting to pass inspection station—Inspection shanty at left and flood-light control station at right



Lights in lowered position before hinged covers to pit box are closed



Details of one of the batteries of three 200-watt flood lights

two outside lights 3 ft. 3 in. from the bottom of the pit and the center light 3 ft. 6 in. from the bottom of the pit. The two outer lights, used for truck inspection, are set to give level beams of light about 10 deg. inward from the normal so that each truck will be well lighted both when approaching and leaving the inspection station. The center light, used for body inspection, is set with the beam normal to the track but elevated approximately 10 deg. for best results.

The pit box is made of 2-in. plank, moisture being excluded by the sealing of all joints with a waterproofing material. A drain is provided in each box, the top of which is set about 2 in. above ground level. The box covers are painted white and the entire flood-light installation kept neat and clean. Electric connections to the lights are made of waterproof insulated wire about 4 ft. long. Individual electric control of the lights is provided at each box and also at one central station so that all of the lights can be turned on or off at one time. In the interest of economy, the flood lights are turned on only while cars are being inspected. The location of the inspector's shanty is such that approaching trains can be seen through the windows and the outside inspector signaled to turn on the lights, thus avoiding unnecessary crossing of the tracks in front of trains.

A question may arise in the minds of some as to whether or not a thorough inspection can be made of freight cars while they are moving. There are two important factors in the successful working out of this arrangement. First is the installation of flood lights at the proper location to give a full illumination for night inspection of all car parts; and second is the movement of the cars past inspection points at the proper speed. The speed of trains approaching the top of the hump is controlled by electric-light signals located at intervals along the incoming track on the engineman's side. These signals, controlled from the yardmaster's shanty at the top of the hump, indicate red for stop; yellow for a slow speed of 6 m.p.h.; green and yellow for medium speed; green for full speed; and red and yellow for back-up. On account of the provision of two leads to the hump, on one of which a train may be approaching while the train on the other is being inspected, two stop boards are installed opposite the inspector's shanty to avoid any possibility of the approaching train passing this point before the inspection of the other train is completed.

In making the inspection, the inspector places himself in the most advantageous position to see common defects and remains there until the train has passed. Wheel de-

Installation of General Electric flood lights at car-inspection station on the Proviso hump

fects are more readily discovered for the reason that the inspector has an opportunity to see the entire circumference of the wheel. No difficulty is experienced in locating cracked truck sides, broken arch bars, broken spring planks, bolsters, etc. As a matter of fact, records indicate that more defects are discovered by the new method of inspection than was the case previously.

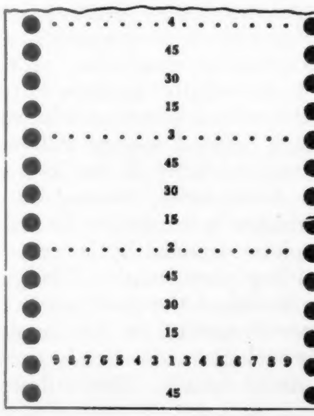
This type of inspection may prove well adapted to the running inspection of "main trackers" at main and intermediate terminals, the inspection being concentrated at one point thus avoiding the delay attendant upon inspectors waiting until trains stop in the incoming yard and then passing over the entire length of the train.

Impact Recorder

THE illustration shows an impact recorder, developed by the Stout Impact Recorder Company, Burlington, Iowa, and successfully used on a number of railroads to give an accurate measure and record of the rough handling of trains.

The machine consists of a clockwork device which moves a strip of paper underneath a pencil point or stylus, mounted on a pendulum arm, the swings of which are dampened by springs. If the train is brought to a sudden stop or jerked in starting, the pendulum is caused to swing across the paper, marking the severity of the jolt. The time lines on the paper, provided the starting point is properly indicated, when compared with the dispatcher's schedule of the train, will give the exact location on the road where the improper handling occurred.

The mechanism fits into an aluminum case shown at the left in the illustration, the window in the case allowing the record to be seen without removing the

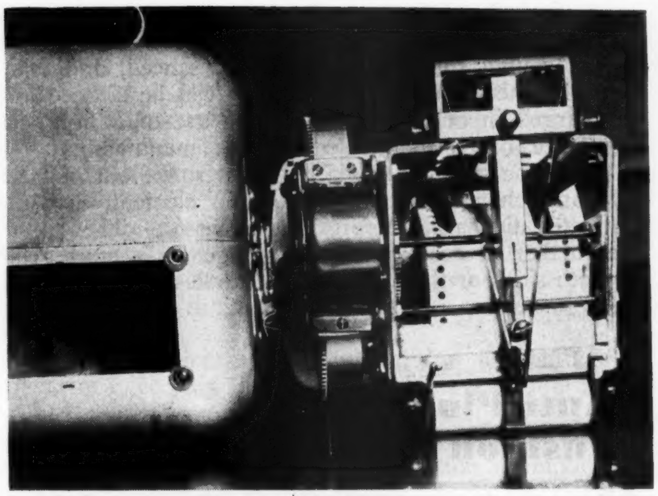


A portion of the recording tape

mechanism from the case. A typical strip of recording tape is also illustrated. Time is shown lengthwise and shock crosswise on the tape.

In operation, this machine is fastened to the floor of a freight car or secured by placing it on the window sill of a passenger car and lowering the inside window sash on top of the machine to hold it in place. The machine should, of course, be positioned so that the pendulum motion will be from front to rear of the train.

The use of a device of this kind removes from the realm of speculation any report concerning rough handling of the train and gives a definite record. Smooth handling would be indicated by a practically straight



Impact recorder used in checking the proper handling of trains

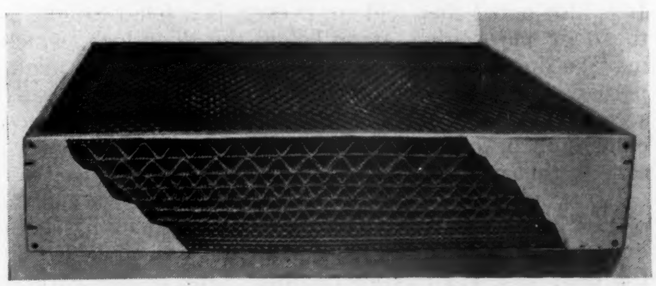
line. A lateral swing to the first dot of the recording tape is equivalent to an impact of three miles an hour, which is rough handling. From then on, each dot indicates an increasing shock up to an impact of nine miles an hour, which would be sufficient to cause considerable damage.

Filter Panels for Air-Conditioned Cars

ONE of the recent developments of the Air-Maze Corporation, Cleveland, Ohio, is an air-conditioning filter panel for which high filtering efficiency with minimum resistance to air flow is claimed.

The filter element of Air-Maze filter panels is built up of filter screens which, it is claimed by the maker, is the only media by which the density of the element can be fixed and controlled. The baffles on which the dust is impinged are, therefore, exactly spaced so that air velocity is held to an even rate throughout the area of the panel—carrying out more efficiently the baffling impingement principle and holding restriction to a minimum.

In order to prevent sharp restriction rise, and to allow greater dust holding capacity, graduated smaller meshes of filter screens are used inward—beginning with



An Air-Maze filter panel for railway air-conditioning service

⅛-in. mesh down to 18 meshes to the inch. Between flat layers are incorporated layers of corrugated design which are in turn graduated, as to size, both in depth of crimp and size of mesh inward, the whole increasing the dust holding capacity since bulky matter is retained on the coarser layers and the crimp allowing the pas-

sage of air between layers in any and every direction.

The cleaning of this type of panel is facilitated by the use of round, smooth wires, exactly spaced, and separated by the crimped layers. They can be cleaned and oil-charged in one operation by the use of a light, inexpensive oil recommended by the manufacturer.

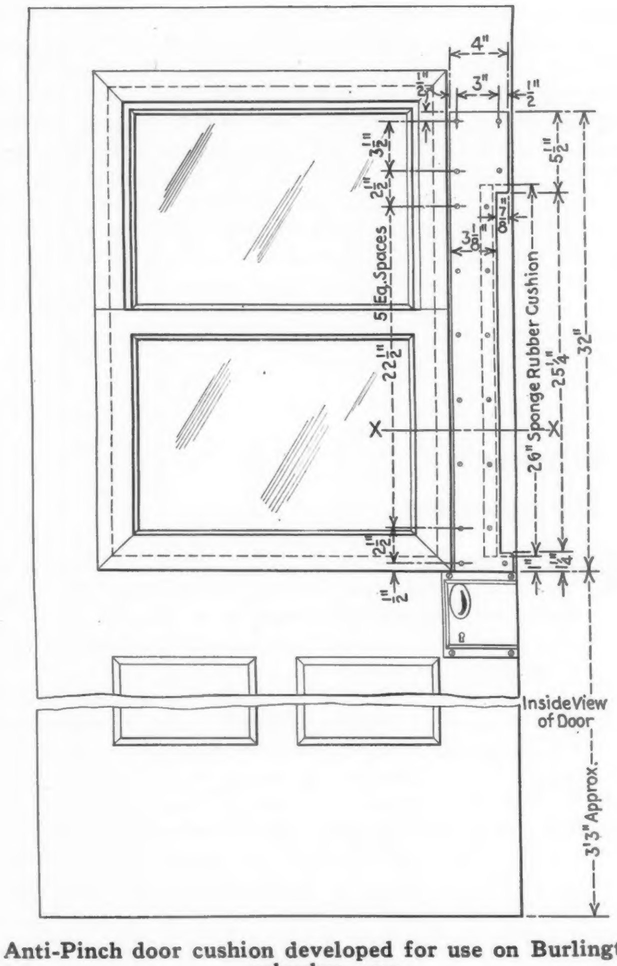
This type of filter media does not shake out of position and change the density of the element, and the characteristics are, therefore, permanent. The panels are further protected against damage by a steel grille on both sides of the panel—with handles being optional.

Anti-Pinch Door Cushion

OWING to the excessive cost and great practical difficulty of maintaining door checks on suburban cars in good operating condition, many roads operate this type of equipment without door-check protection, and occasionally very painful accidents, including bruised or broken fingers and hands, result from unexpected closing of the doors. Careful investigation indicates that a surprisingly large percentage of people grasp the right door post at some point between 3 and 5 ft. above the floor in passing through the doorway of a car and turning to the right down the steps to the ground level. During part of this movement, the hand and fingers frequently cover the door jam and just at this moment a partially-closed door may swing shut, due to sudden stopping of the train, or possibly some passenger, not noticing the fingers in the door jam, may release the door from the full-open stop and kick or push it violently toward the closed position. A serious accident is then almost inevitable.

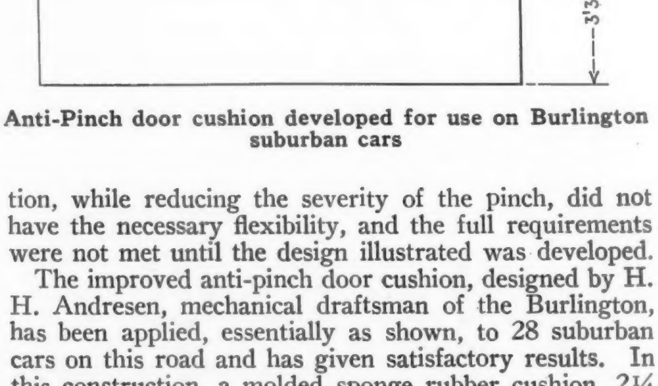
The unsafe practice of grasping the door post in passing out of cars persists in spite of the best efforts of railway men to instruct the public regarding the attendant danger. The prevalence of the practice is indicated by the fact that the paint usually shows unmistakable signs of wear on the right door post between the points mentioned. In fact, on one road, a small skull and cross bones, painted on the door post at this point, was itself completely obliterated by contact with the hands of careless passengers. A rather surprising fact in connection with door jam accidents is that they usually happen in non-rush hours, which can perhaps be accounted for by the lack of a continuous line of commuters keeping the door open as they pass through it. It is also noted that seldom, if ever, is a hand caught in the door jam, either at or below the door lock, which may be due to the fact that small children, who might perhaps grasp the door post at a low point, are usually accompanied by parents or older people experienced enough to be on their guard and protect their charges against this particular type of accident.

To avoid the possibility of painful and costly accidents of this kind, the Chicago, Burlington & Quincy has been experimenting for some time with the use of rubber in the door and frame construction. One of the earliest attempts was the insertion of a sponge rubber cushion both in the door and in the door post at the point usually contacted by passengers' hands. This construction produced the desired results but was too expensive, owing to the necessity for cutting away part of the steel door post and frame construction. Another experiment tried was the insertion of a rubber cushion in the door edge with a light, sheet-metal backing plate on the inside of the door to hold the rubber in place. This construction, while reducing the severity of the pinch, did not have the necessary flexibility, and the full requirements were not met until the design illustrated was developed.



Anti-Pinch door cushion developed for use on Burlington suburban cars

The improved anti-pinch door cushion, designed by H. H. Andresen, mechanical draftsman of the Burlington, has been applied, essentially as shown, to 28 suburban cars on this road and has given satisfactory results. In this construction, a molded sponge rubber cushion, $2\frac{1}{4}$ in. wide by $1\frac{1}{2}$ in. thick by 26 in. long, is inserted in the edge of the door, being located as shown in the drawing. This rubber is molded to fit a 24-gage tinned-copper dovetail plate, secured by screws to the edge of the door. A holding plate, made of 16-gage mild steel, is applied on the inside of the door and a narrower plate of the same material applied on the outside to assist in holding the rubber which is also firmly cemented to these plates and to the dovetail. The rubber has an un-



Section through the door cushion with the door closed

supported width of 1¾ in. on the outside and 1⅛ in. on the inside of the door, which gives sufficient flexibility to avoid seriously pinching a hand or fingers which might be caught in the jam. In fact, it is said that the door can be closed and latched with a hand in the jam and not injure it. Reference to the drawing shows a clearance of ⅛ in. between the edge of the rubber and the door post, which is necessary to provide for free swinging of the door.

Preparing Freight Cars For Road Service*

By J. A. Deppe†

THE trend today seems to be towards greater train speeds. Trial runs recently made have developed speeds which were unheard of only a comparatively short time ago, and which it is believed are but a forerunner of what may be expected in the future. Freight trains today are moving over the railroads quite regularly on passenger-train schedules, and 50 m.p.h. and over is getting to be a regular thing, being accomplished with equipment which we formerly hesitated to operate at so-called passenger-train speeds. Increased speeds require that the equipment be in first-class shape, necessitating the best of attention in the way of inspection and repairs.

In considering this subject, let us start with cars arriving off-line. It is important that as thorough an inspection be made as possible. I use the word "possible" knowing we all recognize that because of close connections at the larger interchange points, also the need for prompt placing of cars for unloading, it may be necessary to get over inbound trains rather hurriedly. However, efforts put forth at such time to detect defective conditions will be well repaid later in getting outbound trains prepared for road haul as it will often prevent cars just unloaded from being loaded again in a defective condition. The cars will be sent to the repair track where proper repairs can be made, and thus save bad ordering the cars after they are loaded or trying to fix them in the train yard. The best method is to condition the cars when they are empty.

Every opportunity should be taken to go over empty cars before they are placed for loading, and, where work required is of such a nature as to necessitate repair-track attention, that should be arranged for by having equipment held for loading inspected sufficiently in advance so that it may be moved to the repair track if necessary. One of the difficult problems is that of a car being placed for unloading and being loaded again at the same industry or freight house. At some of the larger freight-house tracks, car inspection and repair forces with necessary facilities are available for testing air brakes and repairing them where necessary; also making repairs which would ordinarily require movement of the car to the repair track. I would not advocate this arrangement as a substitute for a regular repair track because the spacing of tracks and cars does not make for ideal working conditions. However, we must fit in with local operating conditions, and, therefore, it is desirable to do as much of the work at freight houses as is possible. Obviously, this, in many cases, avoids the expense of switching cars which would otherwise be bad ordered to the repair track, and above all it helps out in efforts to get the cars prepared for road haul.

Assignment of Inspectors to Cover Industry Tracks

In the larger terminals, it may also be of benefit to have inspectors assigned to cover industry tracks and yards. Such inspectors will catch cars which have developed defects in switching and thus avoid reloading them in bad order; also often permitting such repairs to be made as will avoid switching cars to the repair track. We have found such an arrangement to be of considerable help in conditioning cars for movement over the road.

Many of the cars taken into trains for outbound movement have been loaded by industries operating their own equipment and such cars are usually given preparatory attention by the owners before being loaded or while being loaded. This co-operation is important because the cars contain high-class freight moving in fast trains and are frequently brought to the train yard very close to departure time. The necessity of performing considerable work on them in the way of running repairs often would result in late departure of the train. With loaded cars coming from freight houses and industries where there has been an opportunity to go over the equipment, train-yard forces will have to make but few repairs other than those occurring in the switching movement, and, therefore, will be able to give more attention to cars arriving in transfers from connecting lines, etc. They will then be able to devote more of their efforts to making a careful inspection of all cars and such repairs as may be necessary on cars which have not had prior attention or have developed defects in switching. Many outbound trains receive cars coming from connecting lines which must be carefully gone over by inspectors and repairmen in the train yard and as a rule they have to hurry the work to get the train out on schedule. I mention this again to emphasize the importance of doing what we can to prepare the equipment we have at various loading docks in our own terminals so as to give the train-yard forces more time on other cars which have not received this prior attention.

Adequate Time for Inspection and Repairs

The number of inspectors, oilers, etc., required in a train yard will depend largely on local operating condi-

Making an air-brake test

* Abstract of a paper presented before the Car Foremen's Association of Chicago, December 10, 1934.

† Assistant Superintendent Car Department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wisconsin.

tions; also to what extent cars are being given attention before arrival at such yard for outbound movement. In addition, you have the intermediate terminal which may be quite important as to the number of trains handled in and out, and I do not know that I would even want to suggest the force requirements. Each of us has his own situation to deal with, and we know that, due to varying conditions, each terminal presents its own problems and usually these can best be worked out by the local organization. However, it is essential that sufficient time be allowed after trains are made up to permit the men assigned to the job to inspect all cars carefully and make necessary repairs. We all know what these repairs consist of, and if we are going to avoid detentions en route, let us be sure that nothing is left undone to see that the equipment is in good condition before departure from the yard because this will save considerable time, trouble and expense.

I feel that the car oiler, or box packer as some of us term him, is a most important employee, and there should be sufficient time allowed for the force employed to do a good job of servicing the journal boxes. It is a good practice to require car inspectors to open all journal box lids and look for worn bearings, waste grabs, etc. The box packers should follow the inspectors, adjust the packing, and change all bearings marked by inspectors, either for renewal or cleaning bearings of waste grabs. Each box packer should carry a can of car oil and when the packing is being adjusted and appears to require oil, a small amount should be added. Obviously, this must be left to the judgment of the man doing the work, but if he has been properly instructed by his supervisor and his work is checked from time to time, we may be satisfied that the proper amount of oil will be used and only where needed.

When temperatures are 10 deg. F. or lower, we find that the addition of a small amount of car oil having a low pour point will be helpful in preventing trouble. It is our practice to require car oilers during cold weather to add such car oil to all journal boxes, this oil being applied to the rising side of the journal. The oil used when temperatures are 10 deg. F. or lower has a pour point of minus 30 deg. F., and we have found that the use of this oil reduces the amount of hot-box trouble formerly experienced. When the packing is frozen, it is difficult to get immediate lubrication when starting out of the yard with a train unless free oil is applied to the journal. When temperatures are higher than 10 deg. F., we use regular specification car oil, which has a pour point of zero, and such oil is applied only to boxes having so-called dry packing.

The conditioning of the journal packing and the renewal of brasses where necessary is about the most important job to look after, but, of course, the other parts of the running gear and appliances for the safety of car and trainmen are also very important. Making the proper air-brake test is even more essential today with the trains operating at the higher speeds, and sufficient time should be allowed for making the prescribed test, checking for inoperative brakes, leaks, etc., and also checking and adjusting piston travel.

Broken or Missing Cotters May Cause Train Wrecks

Whenever I am on the subject of preparing cars for road movement, I always feel it necessary to say something about cotter keys. With the fast operating schedules we have today, it is more important than ever to know that the brake rigging is in good condition, and none of it can be any better than the cotter keys which hold the rigging in place. Every once in a while we run into an epidemic of trouble caused by brake rigging coming down, and then a campaign is instituted to see that the cotter keys are renewed where the old keys are considerably worn. It is really astounding to see the condition of cotter keys on cars operating over the railroads, and I am sure everyone will agree that it is time and money well spent renewing worn split keys and cotter keys.

I have endeavored to cover some of the things which we consider helpful in getting freight trains over the road and, when we consider that the distances between inspection points have been stretched to the extent where a few years ago we would have said it couldn't be done, the need for carefully preparing cars becomes more evident.

For a period of about two months this fall, the Milwaukee operated a fast merchandise train from Chicago to Minneapolis, Minn. The usual run of freight cars of system and foreign ownership was used exclusively in these trains, and, while the distance of 421 miles was covered in 11 hours and there was but one intermediate inspection point at which a running inspection was made while the train was held just long enough for the locomotive to take water, there was but one detention chargeable to equipment failures, and that was due to a hot box. The successful operation of these fast trains brought out very forcibly the fact that it pays to make a good job of conditioning the equipment at the originating terminal, and also bend every effort to see that cars are conditioned in so far as possible before they are brought to the train yard.

Draft Gear Inspection And Maintenance

In its 1934 report the A.R.A. Committee on Couplers and Draft Gears included recommendation for rules for systematic inspection and maintenance of draft gears. This recommendation was approved by the General Committee and submitted to letter ballot vote. As a result the following rules have been adopted as Recommended Practice covering "Inspection and Maintenance of Draft Gears and Attachments by Car Owners":

"1. When cars are on repair tracks for periodic air brake attention, examine and renew defective parts of draft gears, couplers and their attachments and supports. This will not require removal of draft gear for this examination, except where found defective or where total slack from coupler horn to striking casting exceeds 1½ in.; slack to be the difference in distance between coupler striking horn and striking casting when coupler is pulled out with a bar and sledged back solid.

"2. When cars are undergoing general repairs, draft gears will be dropped for examination, and couplers, their attachments and supports will be inspected and necessary repairs and replacements made.

"3. In renewing defective draft gears, certified gears should be applied if spacing permits, or serviceable secondhand gears of other types, not considered inefficient or obsolete as per list shown in A. A. R. Interchange Rule 101, may be applied. Certified gears must be renewed with certified gears."

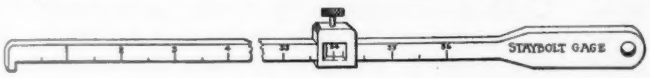
In sending out the above notice the Mechanical Division requested car owners to see that these rules are strictly enforced on their own cars, in order to improve the condition of couplers and draft gears by elimination of slack in the gears as far as possible.

In the

Back Shop and Enginehouse

Simple Gage for Length of Staybolts*

THE staybolt gage shown in the illustration can be made from a piece of ½-in. by ⅛-in. sheet steel and with it only one man is required to get the shortest possible length of staybolt. By using the shortest bolt allowable waste of both material and time are avoided. Because of the difference in the radius of the inside and outside sheets of the firebox, the staybolts become increasingly longer as the center of crown sheet is approached and as a consequence different lengths of staybolts have to be used. In using the gage the point



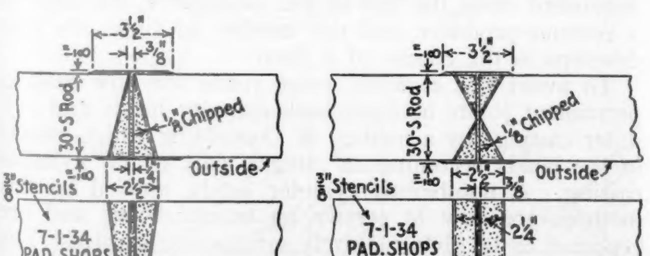
Gage for length of staybolts with allowance for heading on both ends of bolt

is entered through the holes in both sheets and hooked over the second sheet. The thumb slide is then pushed down to the sheet and the required length of staybolt to be used will then be visible through the opening in the thumb slide. The measurement shown allows for two and one-half threads for laying down on each end of staybolts.

* An article submitted by a locomotive inspector who designed the gage described.

A Unique Welding Job

AN unusually ingenious and substantial method of welding an integral steel cylinder casting and front-frame section to the main frame of heavy modern locomotives has been developed and is now being used successfully on the Illinois Central. Instead of making a single butt joint and weld at the middle of the upper rail of each front main jaw, the new frame section on each side is butted against and extended back over the old frame in a right angle and welded as shown by chalk lines in the illustration. This construction gives so much



Method of cutting out locomotive frames preliminary to welding—*A:* Frames 4½ in. wide and less—*B:* Frames over 4½ in. wide

added contact area at the weld as practically to preclude any possibility of failure, provided the proper welding procedure has been followed.

The general method of making frame welds on Illinois Central locomotives is illustrated in the drawing. The first operation is to tram the frame section in the usual way. The frame is then cut out at the point to be welded in the form of a vee, as shown at A, for frames up to and including 4½ in. in width and at B for frames over

Integral steel cylinder and front frame section joined to the main locomotive frame by a unique right-angle weld

4½ in. wide. The cutting is done with an oxyacetylene torch as far as the construction lines, the oxidized surface then being chipped back to the full lines.

The frames are expanded ⅛ in. during the time the weld is being made, using a wedge or jack, or by heating the opposite member of the frame section. The next operation is to reheat with an oil torch and charcoal, using a netting basket approximately 14 in. by 14 in. by 16 in. deep and maintaining a temperature during the welding of 500 to 800 deg. F.

Two operators perform the welding operation, working from opposite sides at the same time on frames over 4½ in. wide. They use ¼-in. or 5/16-in. shielded-arc electrodes and reverse polarity of the welding machine. The welds are built up on the top with just sufficient extra stock to permit grinding flush with the frames. The vertical sides are reinforced with a ⅛-in. layer of special wear-resisting steel, the edges of which are ground on a taper, as shown in the drawing, so as not to leave a shoulder. Care is exercised to clean each layer of welding bead thoroughly by the use of a chisel and sand blast before applying the next one.

After the welding is completed, the frame is normalized as follows: In the case of mild cast steel, the frame parts adjacent to the weld are heated to 1,500 deg. F.

with an oil torch and allowed to cool in a charcoal fire. For vanadium cast steel frames, the parts are heated to 1,550 deg. F. with an oil torch, the charcoal basket being then removed and the frame allowed to cool in the open air below 800 deg. F. The basket is replaced and the temperature raised to 1,200 deg. F., the frame then being cooled in the fire to 800 deg. F. and finally to shop temperature in the open air.

As soon as contraction commences, the wedge or jack is removed and the contraction observed by the use of a tram during the cooling process. If the contraction is too great, a wedge or jack is applied or the parts heated in the usual manner to obtain the required length. If possible, the welding operation is continued without interruption until completed. The date of the weld, shop at which the weld is made and the welder's number are stamped on the frame adjacent to the weld, as shown in the drawing.

Impact Type Wrench Adapted to Railroad Work

THE Ingersoll-Rand Company, New York, has recently placed on the market a wrench known as the Potts impact wrench which is adapted to such railroad shop work as removing and applying staybolt caps, cylinder- and valve-chamber-head nuts, dome nuts, front-end nuts, smoke-box nuts, frame-bolt nuts and wash-out plugs.

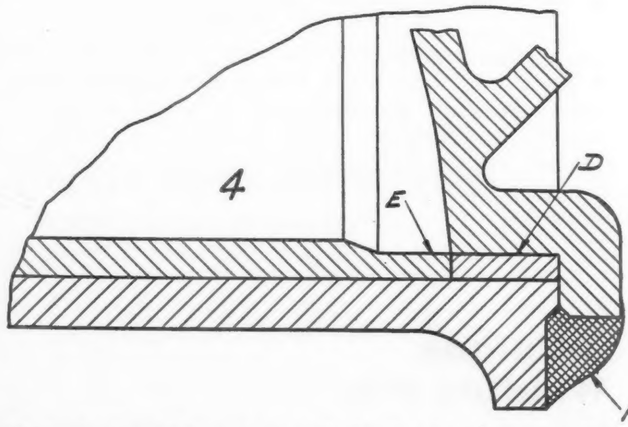
The wrench consists of a multivane air motor driving the impact wrench unit which is made up of an accumulator, hammer piston and anvil all enclosed in a hammer case. As the torque from the motor is applied to the accumulator the twisting action is applied to a rubber section lifting the hammer from its seat. The energy stored in the accumulator drives the hammer forward so that it delivers a powerful blow to the anvil one end of which is attached to the chuck. The accumulator absorbs the torque and eliminates the danger of shock or injury to the operator. The cushioned action makes it possible to operate the impact wrench on high places or in positions that might otherwise be unsafe.

The I-R. Potts impact wrench being used on staybolt caps

These torsional impacts, occurring at the rate of 1,200 to 1,400 blows a minute, exert a powerful turning effect. This type of turning action makes it possible to remove nuts which could not be taken off except by splitting with a chisel or burning with a torch.

Applying Back Cylinder Heads by Welding

SINCE the back cylinder heads of locomotives carry, roughly, one-half of the weight on the guides and, in addition, seal the back ends of the cylinders against high steam pressure under extreme vibration and direct load stresses, as well as expansion and contraction stresses, considerable difficulty is sometimes experienced in maintaining steam-tight connections with the heads attached in the conventional way by studs and nuts. Until the comparatively recent development of a welded application, the only method of correcting a leaky back cylinder head was to take the locomotive out of service, pull the piston, remove the main rod and crosshead, remove the back cylinder head and holding studs, grind the head to a new joint on the cylinder casting, and reapply all of these parts in the reverse order mentioned. Considering the out-of-service time of the locomotive, as well as direct labor expense, the cost of this work may reach a considerable amount, dependent upon the size of the locomotive, its value as a revenue-producer and the number of times the leak develops in the course of a year.



Method of applying steel cylinder heads to steel cylinder castings, using a special steel welding rod

To avoid this expense, some roads are now making permanent joints between back cylinder heads and cylinder castings by a method of Oxwelding which results in the heads becoming an integral part of the cylinder casting. A number of cylinder heads, applied by this method, are now in service on several roads and are reported to be giving entirely satisfactory service. The drawings and instructions included in this article describe in detail the procedure followed in bronze-welding steel cylinder heads to cast iron cylinder castings and welding steel cylinder heads to steel cylinder castings, using a special steel welding rod. Bronze-welding is, of course, always used with cast iron cylinder heads.

Experience has shown that the retention of the studs and nuts with cast iron cylinders is not essential, although, if omitted, a substantial reinforcement of bronze-welded metal should be applied.

The average cost of welding a back cylinder head to a casting varies from $25 to $65, depending on the diameter of the cylinder head, and also on the welding procedure followed. The outstanding advantages of the application of cylinder heads by this method include: Heads made integral with the cylinder casting; cylinder casting strengthened by the integral heads; leakage permanently eliminated; replacement of studs and nuts eliminated; regrinding of head seats eliminated; running repairs or enginehouse maintenance expense for this work eliminated.

Welding Steel Cylinder Heads to Cast Iron Cylinders

Referring to the drawings, the detailed procedure in bronze-welding a steel locomotive cylinder head to a cast iron cylinder is as follows: Remove the back head and all studs; then chip or grind the face *A* of the stud flange of the cylinder casting to clean the base metal. Turn the outside edge *B* of the head down to the diameter of the outside of the nut bearing surface and bevel the inside of the flange as indicated at *C*.

Apply a band *D* to the shoulder of the head to increase the diameter to a slip fit in the cylinder casting. The bushing should then be shortened to butt against the edge of the band, as indicated at *E*. Groove the studs to the diameter of the bottom of the thread, as indicated at *F*, and replace the studs in the cylinder casting. This grooving of the studs and providing the radius on the inside of the head bevel permits bronze-welding under or inside of the studs and thus assures a steam-tight joint.

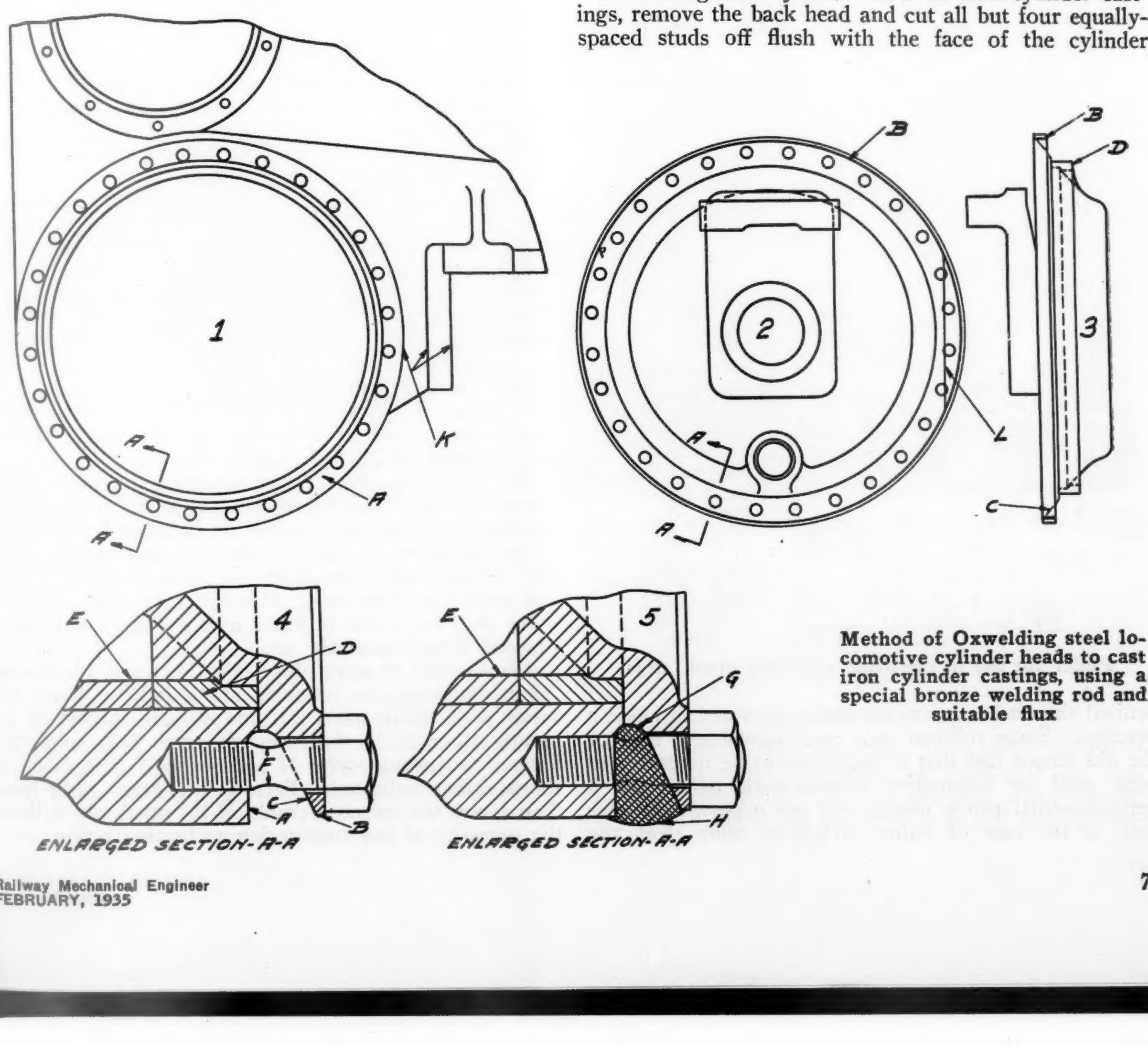
Set the cylinder head in place, lining up the face of the guide blocks or brackets with the top of the frame and then apply and tighten all nuts firmly. Preheat the cylinder and head the same as for bronze-welding a break in the same general location and weld with No. 25-M bronze rod and Brazo Flux. The weld should be started at the bottom of the head and the cylinder casting, then being carried up both sides and across the top by two operators working simultaneously. Special care should be exercised to be sure that areas under the stud are filled with bronze properly "tinned" to the surface of the head and cylinder casting, as indicated at *G*.

When the weld is completed, the entire heated section of the head and casting should be covered and allowed to cool slowly. In the event that the edge of the head does not clear the frame or frame seat lug *K* of the cylinder casting, the edge of the head should be cut off, as indicated at *L* and the bronze built up to the dimensions of the section of the head which was removed. The nuts should be applied to the studs in the built-up section when the weld is completed and cooled.

It is important that the bronze weld be reinforced, as indicated at *H*, and that none but thoroughly qualified, competent operators be assigned. All surfaces to which bronze is applied must be entirely free from dirt, rust or scale. When the entire cylinder and heads have become cold, the nuts on the studs should again be set up firmly and left in that position.

Welding Steel Cylinder Heads to Steel Cylinder Castings

In welding steel cylinder heads to steel cylinder castings, remove the back head and cut all but four equally-spaced studs off flush with the face of the cylinder



Method of Oxwelding steel locomotive cylinder heads to cast iron cylinder castings, using a special bronze welding rod and suitable flux

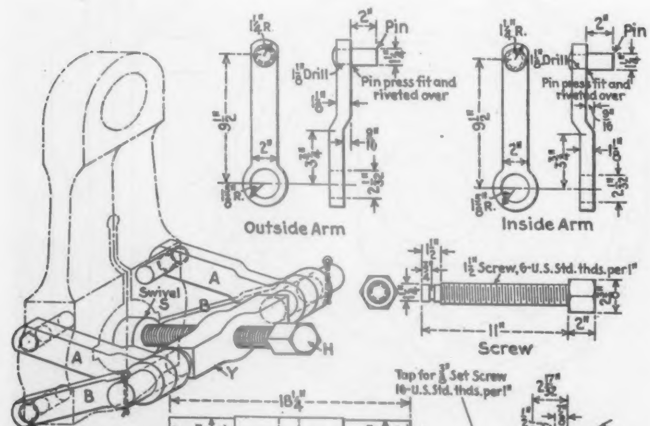
casting. Cut the flange of the head off on the inside radius of the stud holes with a cutting blowpipe, with the exception of the portion around the four studs. Apply a band to the shoulder of the head to increase the diameter to a slip fit in the cylinder casting, as indicated at *D*.

Set the cylinder head in place, lining up the face of the guide blocks or brackets with the top of the frames and clamping the head in place with nuts on the four studs which were left in place. Preheat the cylinder and the head as for welding any break in the same general location and weld with No. 1 H. T. steel rod. The weld should be started at the bottom of the head and cylinder and carried up on both sides and across the top by two operators working simultaneously. The clamping studs should be cut off flush with the cylinder face as the weld proceeds. When the weld is completed, the entire heated section of the cylinder and head should be covered and allowed to cool slowly.

It is important that the cross section of the weld and reinforcement be as indicated at *F* on the single small drawing and that none but thoroughly qualified and competent operators be assigned to this work.

Applying and Removing Eccentric Cranks

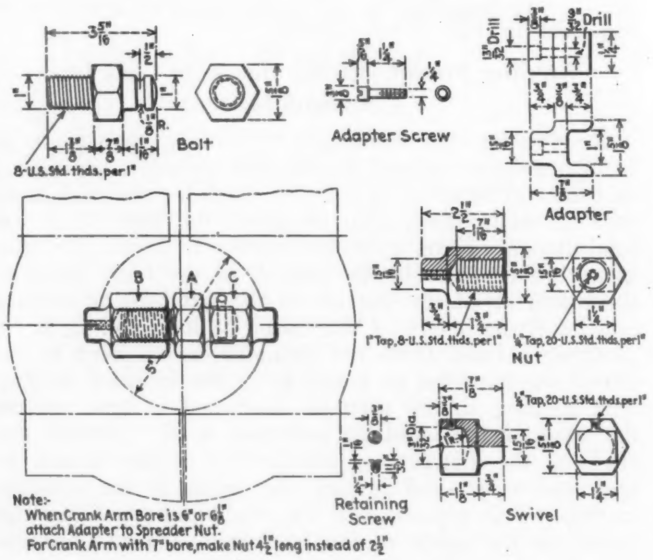
NOT much thought was formerly given to the application and removal of eccentric crank arms on locomotives equipped with Walschaert valve gears. A thin taper wedge was roughly driven into the slot usually provided at the large end of the crank, and the crank was then hammered on or wedged off the crank pin, using a sledge hammer and more or less "strong-arm" tactics, which almost, unavoidably, dented or



Puller for use in removing eccentric crank arms

bruised the steel in a way no longer tolerated in modern practice. Some railroad shop and enginehouse men of the old school feel that it ought not to be necessary to treat steel or locomotive motion-work parts like a temperamental prima donna, and yet experience shows that, in the case of either carbon or alloy steel, the slightest surface imperfection, such as a chisel mark, hammer indentation, or accidental heating with a cutting torch, may serve as the starting point for a progressive fracture which will result in the ultimate failure of the rod or other motion-work part, subject to severe stresses in service.

To avoid the necessity of using "strong-arm" methods in applying and removing eccentric crank arms, one large midwestern carrier uses the eccentric-crank spreader and the puller shown in the illustration. The spreader consists simply of a 1-in. hex-head bolt *A*



Spreader for use in applying eccentric crank arms

threaded on one end into a special nut *B* and secured on the other end by means of a groove and retaining screw to a special swivel *C*. Both the nut and swivel have hexagon faces and are provided with squared ends which fit into the eccentric arm keyways.

In operation, the spreader is inserted in the hole in the crank arm, as illustrated, and the bolt *A* backed out of nut *B*, exerting a spreading pressure on the two sides of the arm and enabling it to be easily applied over the end of the crank pin. After the arm is partially applied, the spreader can be removed and the crank arm readily driven home, using a special flatter or copper hammer. The spreader, illustrated, is designed for use with crank-arm bores of less than 6 in. For larger sizes special adaptor is used and for crank arms with a bore of 7 in. the nut *B* is made 4½ in. long instead of 2½ in. long.

For removing eccentric crank arms, the puller illustrated is used. This device consists of a forged yoke *Y* machined as illustrated, a 1½-in. hexagon-head forcing screw *H*, swivel *S*, inside arms *AA*, and outside arms *BB*. These arms are offset 9/16 in. and drilled at one end with 2-in. holes to fit over the yoke ends. On the other end, each arm is fitted with a 1¼-in. pin which projects 2 in. out of the arm.

The method of using this puller is clearly illustrated. After removing the eccentric crank holding bolts, the inside and outside arms *AA* and *BB* are applied by inserting the pins in the eccentric crank bolt holes, the yoke *Y*, adjusting screw *H* and swivel *S* then being in the positions indicated. Turning the screw right hand then forces the eccentric crank off the crank pin without the necessity of any hammering or heating action.

The Maintenance of Diesel Engine Cylinders

By H. H. Moor*

AN article under the above title appearing in the January issue of the *Railway Mechanical Engineer* discussed the boring and grinding process of cylinder finishing and refinishing. The actual effect of cylinder finish upon motor operation has been a matter of conjecture and, for the purpose of establishing definite facts, the Micro Corporation, Bettendorf, Iowa, has conducted a series of laboratory tests under exacting conditions. While the purpose of these articles is to acquaint railroad shop men with the factors involved in the problem of refinishing the cylinder liners of Diesel engines it may be worth while to look to the field of the gasoline engine in which a wider variety of experience has been obtained in order to determine what shop processes may be desirable. Although the tests in question were made with gasoline motors, the results indicate that motor efficiency and operating costs are affected by slight differences in the quality of cylinder finish and there is no reason to believe that this factor is of less importance in the functioning of a Diesel engine.

Fig. 1—A dry-ground cylinder finished with a 36-grain wheel as it appeared before service

In conducting the Micro tests three new eight-cylinder automobile motors of like design were used, the cylinders of each being finished by a different process of grinding. The cylinders of motor No. 1 were finished by dry grinding with a 36-grain grinding wheel, which produced a good commercial finish. The cylinders of motor No. 2 were finished with wet grinding with the same wheel as No. 1, producing a glazed finish superior to the dry-ground surface. The cylinders of motor No. 3 were also finished by wet grinding, but with a 60-grain wheel, which produced a mirror-like finish. The original bore of these motors was 3.125 in. and the cylinders of all were finished .010 in. over-size and fitted with rough-turned rings and pistons of the same design and weight as were originally used in the motor. Each motor was block tested for a period equivalent to 5,000 miles of road operation, a fan dynamometer being used to develop a brake load. For regulating speeds, a standard speedometer was used and the speeds of all three motors were maintained as nearly as possible according to the following schedule:

First 500 miles	20 m.p.h.
500 to 1,000 miles	25 m.p.h.
1,000 to 2,000 miles	30 m.p.h.
2,000 to 5,000 miles	35 m.p.h.

For obtaining the above increased speeds the blade centers of the fan dynamometer were regulated. Every possible precaution was taken to insure accurate results in these tests. The timing of all motors was carefully checked so that the advance and retard were the same in all cases and the same carburetor was used; the valves were all accurately ground before the test was started, and the valves of all motors were set to a uniform clearance. The same grades of gasoline and lubricating oil were used throughout the tests.

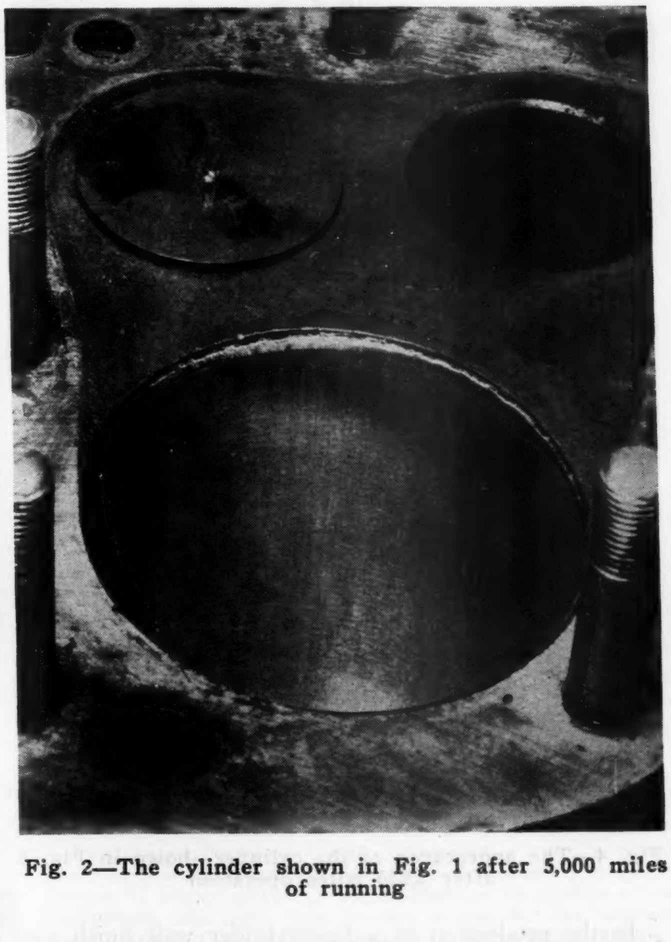


Fig. 2—The cylinder shown in Fig. 1 after 5,000 miles of running

Results of the Tests

The accompanying illustrations show the condition of the cylinders before and after the 5,000-mile test run. The results of the tests showing the wear at the top and bottom of cylinders and the relation of fuel and lubricat-

* The Micro Corporation, Bettendorf, Iowa.

ing-oil consumption are shown in the accompanying table.

Results of Tests Showing the Wear at the Top and Bottom of Cylinders and the Relation of Fuel and Lubricating-Oil Consumption

	Average wear of all eight cylinders, in.		Total lubricating oil consumption, qts.	Average miles per gallon of gasoline
	Top	Bottom		
Dry ground motor...........	.0007	.0002	3	10.36
Wet ground motor...........	.0002	.0001	1½	12.14
Superior wet ground motor...	.0002	.0001	1¼	12.58

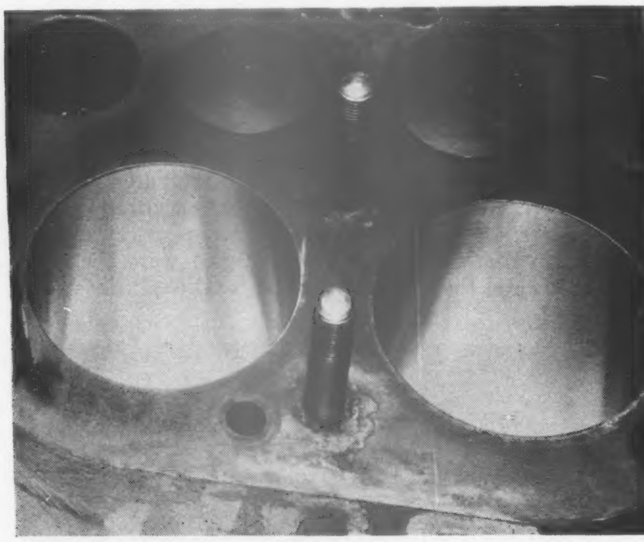


Fig. 3—Cylinder finished by wet-grinding with a 36-grain wheel, before service

Fig. 4—The appearance of the cylinder shown in Fig. 3 after 5,000 miles operation

In the production of a fine cylinder wall finish wet grinding is superior to dry grinding and highly glazed cylinders finished with a fine grain wheel offer a still greater economy and improvement in motor operation in the form of high compression, full explosion power, maximum efficiency, smooth operation, and the longest interval between reconditioning periods.

Grinding Practice

It may be appropriate to mention that the proper application of the grinding solution is highly important for

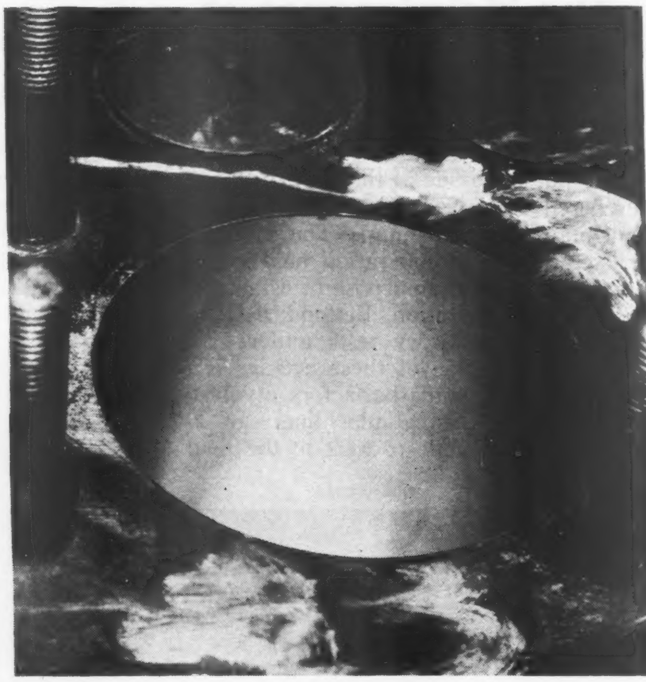


Fig. 5—A cylinder finished with a 60-grain wheel, wet ground, before being run at all

producing the best results. Running the wet solution into cylinder bores with a hose usually results in loading the grinding wheel because of the constant dipping of the wheel in the sediment which collects as the result of the grinding operation. It is of great importance that the pores of the grinding wheel be kept free of this sediment, otherwise the cutting action of the wheel is seriously retarded. A liberal supply and an equal distribution of the grinding solution all around the cylinder bore is desirable. An efficient method of application is one in which the solution is pumped through a built-in water clarifier tank, thence through the center of the grinding spindle shaft to a set of baffle plates between

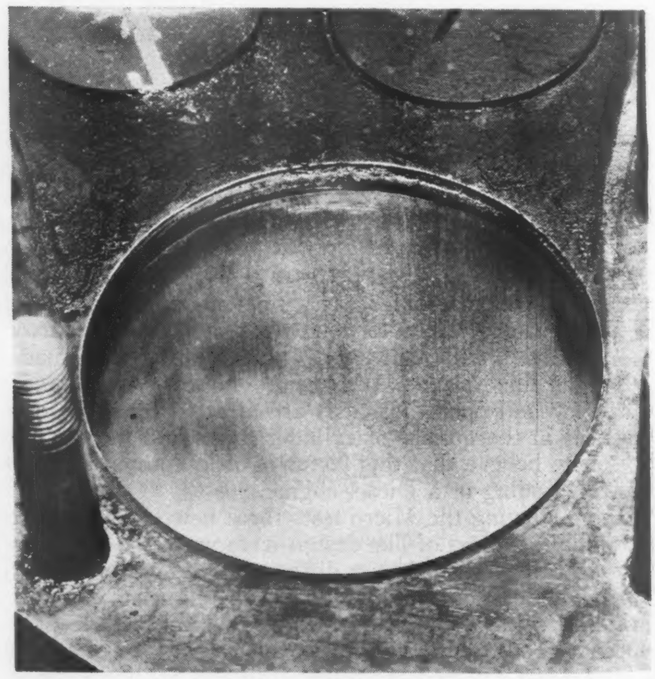


Fig. 6—How the cylinder shown in Fig. 5 appears after 5,000 miles service

the cutting face of the grinding wheel and the cylinder wall.

As the Diesel engine finds a wider application in the railroad field the problem of refinishing cylinder liners will become of increasing importance. This job does not require a type of equipment which is not already in use in the average well-equipped railroad shop. Those roads which now have internal grinders for reconditioning a variety of locomotive parts will find their present machines ideally suited to this work.

In those shops which are not now equipped with internal grinders the presented limited amount of Diesel and gas-engine work should not discourage the use of internal grinders, inasmuch as machines of this type are available fully equipped for handling a wide variety of locomotive parts, such as air pumps, links and blocks, side rods, and valve-motion parts.

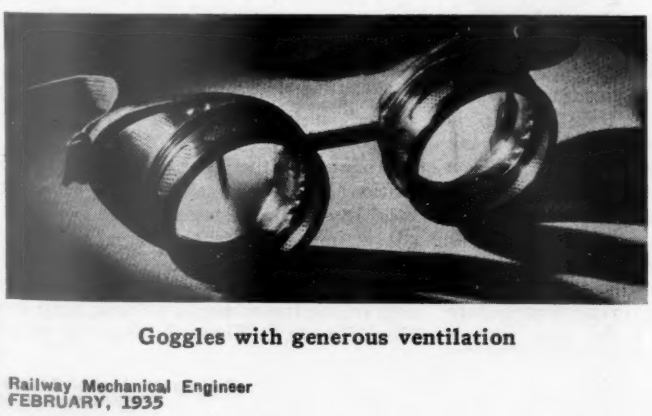
Machine Tool Purchases in 1935

In spite of the fact that most railroads are still operating under policies involving curtailed expenditures, 55 roads, representing 63.5 per cent of the route mileage of the United States and Canada, reported purchases of machine tools and shop equipment for locomotive and car shops during 1934. Some of the more important items ordered were as follows:

Type of Machine	Number of units
Drilling machines	13
Hydraulic presses	2
Milling machines	4
Grinders	24
Shapers	1
Planers	3
Engine and turrent lathes	28
Boring machines	10
Welding machines:	
200 amp.	3
300 amp.	29
400 amp.	11
400-450 amp.	10
750 amp.	1
Unclassified	5
Plate-forming machines	7
Woodworking machines	8
Metal sqws	5

Ventilated Goggle for Hot Workers

For men who work in confined spaces or where the temperature or humidity is high a goggle of a new design, known as Duralite-50 Hot Workers' Goggle, has been developed by the American Optical Company, Southbridge, Mass.

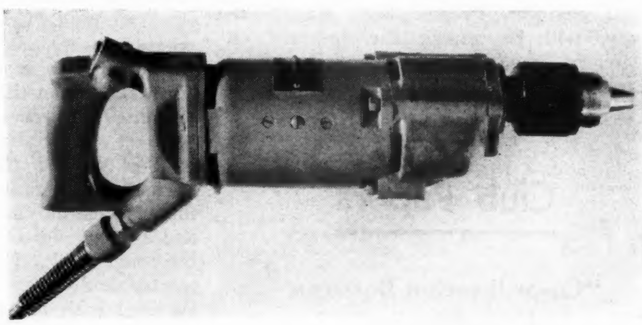


Goggles with generous ventilation

This new goggle practically doubles the area usually allowed for ventilation. The extra ventilation in back of the lenses keeps them free from fogging and steaming and also keeps the area around the eyes cool and so prevents perspiration from obscuring the vision. As a consequence the hazards of stumbling, falling or colliding with objects because of obscured vision due to fogged lenses are eliminated. Besides permitting clear and comfortable vision Duralite-50 Hot Workers' Goggles provide dependable eye protection. They are of sturdy construction and are fitted with super-armorplate lenses.

Hercules Electric Drills

A new line of high-frequency electric drills has been developed by the Buckeye Portable Tool Company, Dayton, Ohio. The new Hercules electric drill, No. 31, is a powerful and sturdy general purpose tool equipped with the new Hercules cool-running,



Hercules high frequency electric drill

high-frequency motor and is obtainable with side handle and switch as well as in the spade handle design illustrated.

The specifications of the No. 31 drill are: Three phase, 180 cycles, 225 volts (also 110); speed, 800 r.p.m.; capacity, 3/8 in., and light 1/2-in. drilling; 3/8-in. Jacobs chuck; overall length, 15 1/4 in.; weight, 10 1/2 lb. Other drills of the same type of construction are also obtainable in various sizes.

* * *

Locomotive Photos.—A new hobby that is rapidly claiming the attention of thousands throughout the country, is the collecting of engine pictures. First sponsored by groups of local enthusiasts, this hobby has become so popular that collectors have formed a co-operative, non-profit organization known as the International Engine Picture Club with headquarters at 280 Broadway, New York City, to facilitate the exchange of such pictures. This club now has several thousand members in all corners of the world. Membership is free to anyone interested. There are no initiation fees or dues. Among its members one finds collectors who prefer to specialize in pictures of new and old motive power, electricity or steam, local or foreign. Others whose interest are more general save all kinds of railroad views including trains, stations, bridges, cars, snow plows, etc. Not only do the members of the International Engine Picture Club collect engine pictures, but also old time-tables, train orders, old prints, pottery, currency, postage stamps and other material depicting the progress of railroading.

Among the
Clubs and Associations

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION.—The next machine tool exposition of the National Machine Tool Builders' Association will be held at the Public Auditorium, Cleveland, Ohio, September 10 to 21.

NEW ENGLAND RAILROAD CLUB.—R. L. Lockwood, director, Section of Purchases, Federal Co-ordinator of Transportation, will present a paper on Railroad Purchases and Standards at a meeting following a dinner which will be held at 6:30 p. m. on February 12 at the Copley-Plaza Hotel, Boston, Mass.

NEW YORK RAILROAD CLUB.—The February 15 meeting of the New York Railroad Club has been designated as Car Builders' Night. Victor R. Willoughby, chief mechanical engineer, American Car & Foundry Company, and M. C. Blest, chief engineer, Pressed Steel Car Company, will be among the speakers on "Modern Trends in Freight and Passenger Cars."

Club Papers

"Co-ordination Between Departments"

New England Railroad Club.—"Co-ordination Between Departments" was the subject of a paper before the New England Railroad Club, at its meeting in Boston, on January 8, by W. J. Patterson, director of the Bureau of Safety of the Interstate Commerce Commission.

Co-ordination of transportation facilities is a subject now on everybody's tongue, the government having undertaken elaborate studies. This, however, is not what I have to talk about, said the speaker, except, perhaps, that it may be observed that some of the objectives dealt with by the Federal Co-ordinator might well be carried out by the Association of American Railroads. And some of these matters have already been attended to.

On the subject of co-ordination between different departments on the same road, however, Mr. Patterson went on to cite varied experiences of his bureau in the enforcement of the safety appliance laws and in the investigation of train accidents.

The legal department, for example; why do not the railroads make full use of the lessons learned in court decisions? For example, the air brake law applies to the movement of freight trains on the main line. The execution of a switching movement over the main line may bring it within the law applying to trains. Disregard of this fact leads to a violation and the railroad is penalized; but the lesson is not applied throughout the lines of that company and there is another prosecution, perhaps more than one, on that same road. The legal department ought to have seen that the operating departments learned their lessons more thoroughly. Thus, a company goes on defending suits in the courts when it should have known and obeyed the law. Moving a defective car to a repair station is a point in which the law is sometimes violated by moving the car farther than is necessary, and there is a suit and a court decision; but the lesson of this decision is not always conveyed to all the local officers who should know about it.

Violations of the hours-of-service law by having train dispatchers or operators work eight hours in one place and then another trick within 24 hours, are occasionally found, and then later the same violation is found on another division of the same road. Co-ordination failed somewhere.

There was a case where an inoperative air brake car in the middle of a train was permitted to proceed when it should have been set out, or should have been switched to the rear of the train, but the only excuse of the railroad company was that the records did not show where the car had become defective. The president of the road, the legal department, the car inspector and others had not properly co-operated with one another.

The speaker then referred to train accidents within recent history, where the inspection of bridges was neglected because of the lack of frequent and full reports of all situations by competent inspectors. In one case a bridge had even become so dangerous that local residents were alarmed, yet officers of the railroad remained in ignorance.

The superintendent of safety should be in close touch with the operating department, but it is sometimes found that he is not. When an accident occurs he should be active in the investigation, but investigations are being held all the time with this man absent. Local officers who may be in some measure responsible for a certain accident are not the ideal investigators of that particular case. A recent derailment brought out the fact that the super-elevation of a curve had been reduced but the speed rule for passenger trains had not been correspondingly modified. In another similar case the maximum speed limit had been increased from 55 m. p. h. to 65 m. p. h., without any improvement in the track. Important trains have been delayed because of defective arrangements for reporting signal failures; an investigation a week after the event is liable to be almost worthless. Reports requiring immediate attention sometimes travel many miles from one office to another before finally coming back to the man who is responsible, who is in the same building with the one who started the report.

Other instances were cited, from the purchasing department and others. Most of us are so situated as not to be able to tackle the Federal Co-ordinator's task or tasks, or any part of his work, but many of the members of the New England Railroad Club, said Mr. Patterson, should be in position materially to promote proper co-ordination of the functioning of his own road.

F. E. Williamson Discusses Railroad Problems of 1935

Central Railway Club.—Frederick E. Williamson, president of the New York Central, speaking before the Central Railway Club of Buffalo, N. Y., on January 10, described himself as an optimist so far as the railroad future as a whole is concerned, saying that "at no time within the experience of my hearers have the railroads been more alert to their responsibilities and, likewise, to their opportunities."

Taking as his subject "Railroad Problems of 1935" Mr. Williamson explained the importance of the carriers to local communities which they serve; refuted the charge that railroads as a whole are overcapitalized; stressed the need for equitable regulation of all carriers; and condemned the St. Lawrence waterway as a project which would "add measurably to the tax burden and this at a time when it is rapidly becoming unbearable." Then turning, as he puts it, "to pleasanter topics" the New York Central president pointed out how the depression has been a spur to progress and to railway enterprise, listing in the latter connection developments such as light weight equipment and streamlined trains and locomotives.

Talking specifically of Buffalo, Mr. Williamson illustrated his first point when he told how the New York Central in 1933 paid to that city alone taxes amounting to $1,192,342. On the three New York Central divisions which serve Buffalo and the Niagara frontier territory it paid in wages $12,000,000 during 1933. Stressing also the importance of railway prosperity to a community's local business, he pointed out how the New York Central in 1930 made purchases in the Buffalo-Niagara territory amounting to $5,400,000, whereas "because of our decreased purchasing power" such local buying fell in 1934 to $1,500,000.

Answering the charge of overcapitalization Mr. Williamson quoted Co-ordinator Joseph B. Eastman, to the effect that "It is impossible to support a claim that an extortionate return, or anything approaching such a return, is now being exacted on the money which has gone into the railroads." These findings, he added,

have "come from such a high and impartial source that they should do a great deal to convince the country of the absurdity of these charges." The speaker, after again quoting Co-ordinator Eastman on the necessity for equitable regulation of all transport agencies, denied that the railroads "seek any unfair advantage over these competitors." He explained that what they seek is simply "to be put on an equality with the unfair competition now offered by various government subsidized means of transportation."

Proponents of the St. Lawrence waterway, Mr. Williamson finds, have recently shifted their emphasis to the power phase of the project and "say little of the shipway feature on which they have laid so much stress heretofore." He pointed out in this connection that regardless of where the emphasis is laid "the net results to the railroads of the east and the middle west and to the railroad men employed on them, will be just as disastrous in either case."

In considering recent railway developments and enterprise Mr. Williamson, while pointing out that "A renaissance of railroading seems in sight," though it nevertheless is desirable to sound a warning lest public expectations be aroused to an extent that disappointment must inevitably follow. He reminded his audience that in a plant as huge as a railroad, radical changes cannot be made overnight, and disagreed with those who believed that the steam locomotive will rapidly be supplanted by other forms of motive power. Each new development in power plants on wheels, he continued, will undoubtedly find a place in the railroad transportation picture. He added that "this does not mean that existing power plants must necessarily be scrapped in the near future." Every railroad manager in the country, he said, is watching with appreciation and sympathy the rapid progress being made by power plants burning fuels other than coal—"the New York Central cannot be accused of lack of appreciation because today we have 45 diesel engined locomotives, more than any other railroad in the world."

In closing Mr. Williamson discussed briefly the New York Central's new streamlined locomotive. In this connection he epitomized the present policy of the New York Central as being one of "attempting to get the utmost in value and service from our existing power plant, while at the same time watching with sympathetic interest the experiments being made by a number of other roads."

Directory

The following list gives names of Secretaries, dates of next regular meetings and places of meeting of mechanical associations and railroad clubs:

Air-Brake Association.—T. L. Burton, c/o Westinghouse Air Brake Company, Thirty-fourth floor, Empire State Bldg., New York. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

Allied Railway Supply Association.—F. W. Venton, Crane Company, Chicago.

Association of American Railroads.—J. R. Downes, vice-president operations and maintenance department, Transportation Building, Washington, D. C.

Division I.—Operating.—Safety Section.—J. C. Caviston, 30 Vesey street, New York.

Division V.—Mechanical.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

Committee on Research.—H. A. Johnson, chairman (Director of Research, Association of American Railroads), Chicago.

Division VI.—Purchase and Stores.—W. J. Farrell, 30 Vesey street, New York.

Division VIII.—Motor Transport.—Car Service Division.—C. A. Buch, Transportation Building, Washington, D. C.

American Railway Tool Foremen's Association.—G. G. Macina, 11402 Calumet avenue, Chicago. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

American Society for Testing Materials.—C. L. Warwick, 260 S. Broad street, Philadelphia, Pa. Thirty-eighth annual meeting, June 24-28, Book-Cadillac Hotel, Detroit, Mich.

American Society of Mechanical Engineers.—C. E. Davies, 29 W. Thirty-ninth street, New York.

Railroad Division.—Marion B. Richardson, Room 332, 30 Church street, New York.

Machine Shop Practice Division.—G. F. Nordenholt, 330 W. Forty-second st., New York.

Materials Handling Division.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

Oil and Gas Power Division.—M. J. Reed, 2 W. Forty-fifth St., New York.

Fuels Division.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W., 1519 Daily News Building, 400 W. Madison St., Chicago, Ill.

Canadian Railway Club.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August at Windsor Hotel, Montreal, Que.

Car Department Officers Association.—A. S. Sternberg, master car builder, Belt Railway of Chicago, 7926 South Morgan street, Chicago. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

Car Foremen's Association of Chicago.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month except June, July and August, La Salle Hotel, Chicago, Ill.

Central Railway Club of Buffalo.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month except June, July and August at Hotel Statler, Buffalo.

Eastern Car Foremen's Association.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings, fourth Friday of each month, except June, July, August and September.

Indianapolis Car Inspection Association.—R. A. Singleton, 822 Big Four building, Indianapolis, Ind. Regular meetings first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m.

International Railroad Master Blacksmiths' Association.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

International Railway Fuel Association.—T. D. Smith, 1660 Old Colony building, Chicago. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

International Railway General Foremen's Association.—William Hall, 1061 W. Wabasha street, Winona, Minn. 1935 meeting tentatively planned for May 2 to 4, inclusive, Hotel Sherman, Chicago.

Master Boilermakers' Association.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. 1935 meeting tentatively planned for May 6, 7 and 8, Hotel Sherman, Chicago.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September.

New York Railroad Club.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

Northwest Car Men's Association.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meeting first Monday each month, except June, July and August, at Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul.

Pacific Railway Club.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

Railway Club of Greenville.—Ralph D. Stewart, 21 Sherrard avenue, Greenville, Pa. Regular meeting third Thursday in month, except June, July and August.

Railway Club of Pittsburgh.—J. D. Conway, 1941 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

Railway Fire Protection Association.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

Railway Supply Manufacturers' Association.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, Association of American Railroads.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

Toronto Railway Club.—N. A. Walford, district supervisor car service, Canadian National, Toronto, Ont. Meetings first Friday of each month except June, July, August and September.

Traveling Engineer's Association.—W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio. Annual meeting tentatively planned for May 2 to 4, 1935, Hotel Sherman, Chicago.

Western Railway Club.—C. L. Emerson, 822 Straus building, Chicago. Regular meetings third Monday in each month except June, July, August and September.

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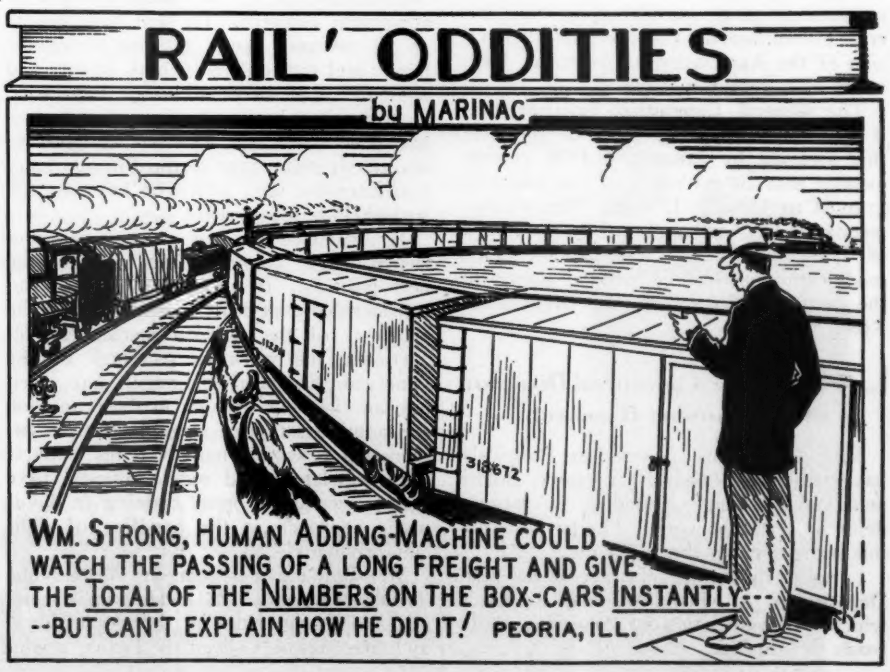

NEWS

The Winton Engine Corporation is constructing a two-car unit with a 3,600-hp. Diesel electric locomotive which will be tried out on various railroads within sixty or ninety days. The locomotive is so constructed that each car unit of 1,800-hp. (two 900-hp. engines) can be operated separately. It will be operated on the Baltimore & Ohio when completed and, later, on the Chicago, Burlington & Quincy to pull the "Aristocrat" between Chicago and Denver, Colo. The locomotive is similar to that recently ordered by the Atchison, Topeka & Santa Fe.

Colonel B. W. Dunn Retires

Colonel B. W. Dunn, manager of the Bureau of Explosives, Association of American Railroads, (whose title is chief inspector), has been retired at his own request, and has been succeeded by Walter S. Topping, assistant chief inspector, who has been with the Bureau since 1907.

Beverly W. Dunn was born in Louisiana, in October, 1860, and was graduated from West Point, as an honor man, in 1883. He served in the Artillery branch until 1890 and was then transferred to the Ordnance department. In June, 1907, he was "loaned" by the President of the United States to the railroads, for the purpose of organizing the Bureau for the Safe Transportation of Explosives and Other Dangerous Articles.

Time Extended for Retirement of Arch-Bar Trucks

Paragraph 3, Section (t), Interchange Rule 3, provides that, effective January 1, 1936, "Trucks with arch bars prohibited under all cars. From owners." Requests for extension of the effective date of this requirement were considered by the General Committee of the Mechanical Division of the Association of American Railroads at a recent meeting.

The General Committee, realizing that it was physically impossible to complete this program by January 1, 1936, recommended that an extension of two years be granted to January 1, 1938. This recommendation has been approved by the Board of Directors of the Association. This modification of Rule 3 will be shown in the next Supplement to the Interchange Rules.

L. W. Wallace Appointed Director of Equipment Research

The Association of American Railroads has created a Research Advisory Board made up of men outstanding in various fields of scientific work. The purposes of this board include the following:

1. Assist in the organization of the new Department of Planning and Research which the Association of American Railroads is forming.

2. Advise as to plans not only for continuing research activities which the railroads already have in progress, but as to plans for research which the Association has in contemplation.

3. Suggest new matters pertaining to operation, equipment or other activities connected with rail transportation to which definite attention should be given in the field of research.

Members of the Research Advisory Board which have been appointed by Mr. Pelley are Dr. Karl T. Compton, Cambridge, Mass., president of Massachusetts Institute of Technology; Dr. Harold G. Moulton, Washington, D. C., president of the Brookings Institution, and Dr. A. A. Potter, Lafayette, Ind., dean of the Engineering Schools, Purdue University.

At the suggestion of the board, Lawrence W. Wallace, vice-president of the W. S. Lee Engineering Corporation, Washington, D. C., was made director of equipment research. He will have charge of all research work relating to motive power and car equipment, both freight and passenger, and succeeds Harley A. Johnson of Chicago, who has been employed on a part-time basis and who has resigned to devote his entire time to the Chicago traction interests, with which he has been associated for many years.

L. W. Wallace

Mr. Wallace has had an unusual experience, which should fit him well for the new position. In addition to having had considerable experience in dealing with the problems of the railroad mechanical department, his work as secretary of the American Engineering Council has given him an excellent training in the promotion and administration of large projects in engineering research; moreover, his contacts with legislators and public officials have made necessary a broad training in diplomatic approach in the handling of difficult problems.

Mr. Wallace was born at Webberville, Texas, August 5, 1881. He studied mechanical engineering at the Agricultural and Mechanical College of Texas, graduating in June, 1903. During his summer vacation in 1901 he was a machinist helper in the locomotive repair shops of the International-Great Northern Railway at Palestine, Texas. After leaving college he served as a special apprentice on the Gulf, Colorado & Santa Fe. In September, 1906, he became a member of the faculty in the mechanical engineering department at Purdue University, serving specifically as assistant in railway mechanical engineering. He remained at Purdue until June, 1917, and was for several years professor of railway and industrial management, and in charge of all railway mechanical work. He was in intimate contact with research at Purdue relating to the mechanical equipment of the railroads, and throughout his association with that university was in direct charge of the courses in car and locomotive design.

During his eleven years at Purdue, all of his summer vacations, except two, were spent in railroad work. This included work in car and locomotive design on the Missouri-Kansas-Texas; locomotive road tests and other work in the test department of the A. T. & S. F.; association with Professor L. E. Endsley in tests for the American Steel Foundries on experimental track and relating to the frictional resistance due to sharp wheel flanges, and also comparative tests of rigid and flexible freight car trucks; preparation of instruction booklets for the Railway Educational Bureau; locomotive road and refrigerator car tests in association with Prof. G. A. Young; road and laboratory tests, in cooperation with the Monon, with respect to behavior of locomotive cinders; and a series of standing tests at Purdue of large New York Central Lines freight locomotives.

While at Purdue he started research on the behavior of locomotive cinders. He has appeared as an expert witness during the last twenty years in 45 or more fire cases, in all of which the verdict has been favorable to the railroad companies. He is the author of a book on "Fire Losses—Locomotive Sparks," which was published in 1921.

From June, 1917, to March, 1919, Mr. Wallace was assistant general manager of the Diamond Chain & Manufacturing Company, Indianapolis, Ind. He left that company to become director of the Red Cross Institute for the Blind, at Baltimore, Md. This was organized for the purpose of training those blinded in military forces during the war. Mr. Wallace organized the institution and mobilized a staff equipped to teach handicrafts and vocational and pre-professional courses.

In January, 1921, Mr. Wallace became executive secretary of the American Engineering Council, then known as the Federated American Engineering Societies. He remained in this capacity until 1934, when he became vice-president of the W. S. Lee Engineering Corporation, in charge of its Washington office.

The American Engineering Council was organized to represent the engineers of this country in public affairs, its headquarters being at Washington. It necessarily came in contact with all branches of the federal government and the Congress,

(Continued on next left-hand page)

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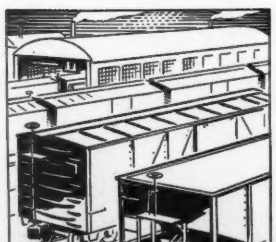

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with respect to matters concerning engineering, industry and related subjects. A number of studies of a technical nature were also made, some of which have had a profound effect upon American industry. Among these were studies on Waste in Industry; Civil Aviation; Safety and Production; Industrial Coal—Purchase, Delivery and Storage; Street Traffic Signs, Signals and Markings; and the Twelve-Hour Shift in American Industry. As executive secretary of the Council, Mr. Wallace organized and directed these studies. He has served on many governmental, industrial and professional committees and boards, including confidential advisory groups relating to the functions, organizations and activities of the federal government.

Mr. Wallace was given the full degree in mechanical engineering by Purdue in 1912, and in 1932 that university conferred upon him an honorary degree of Doctor of Engineering. He is a honorary member of the Masaryk Academy of Work in Czechoslovakia, and in 1924 that government conferred upon him the Order of the White Lion. He is a member and active worker in a number of technical and engineering societies and served four consecutive terms as president of the Society of Industrial Engineers.

P. W. A. Loans

Approximately $6,000,000 of the $200,000,000 set aside by the Public Works Administration, under a provision of the national industrial recovery act passed in June, 1933, authorizing it to aid in the financing of railroad maintenance and equipment upon approval by the Interstate Commerce Commission, was still available at the end of 1934. The total funds advanced to December 31 are shown in the table.

Of the $6,000,000 remaining the Wabash has since received an additional loan of $2,350,000 and loans of $1,206,000 and $80,000 have been made to the New York Central and to the Great Northern, respectively.

A loan of $5,785,000, made to the Great Northern for a general roadway improvement and equipment repair program has also been increased to $5,865,000 because the company has found that the cost of part of the work to be done was underestimated when the original allotment was made. The increase of $80,000 is to cover the underestimate.

Only $15,000,000 for railroad loans was included in the budget estimates for the fiscal year 1936 transmitted to Congress by the President on January 7.

I. C. C.'s Power Reverse Gear Order Held Invalid

AFFIRMING the decree of the federal court for northern Ohio, the Supreme Court of the United States on January 7 rendered a decision holding invalid the order of the Interstate Commerce Commission of January 18, 1933, requiring the railroads to equip their locomotives with power reverse gear. The decision was based on the ground that the commission could make an order of the kind only in the interest of safety and that there was an absence of any real finding that safe operation requires the discontinuance of the manual reverse gear and the substitution of power reverse gear. The railroads are particularly interested in the bearing of this decision on the case pending before the commission in which the railroad brotherhoods have asked it to require the equipment of locomotives with automatic stokers.

At the date of the order there were in use in the United States about 31,597 steam locomotives equipped with hand reverse gear and 28,925 equipped with power reverse gear. Prior to the order, Rule 157, which prescribes the reverse gear on locomotives, left it optional with railroads to equip them with either hand operated or power operated reverse gear. The order amended that rule so as to require the railroads to quip "with a suitable type of power operated reverse gear" all steam locomotives built on or after April 1, 1933; and similarly to equip, "the first time they are given Class 3 repairs or heavier," all steam locomotives then in road service, "which weigh on driving wheels 150,000 lb. or more," and all then used in switching service "which weigh on driving wheels 130,000 lb. or more." The order required that all such steam locomotives be so equipped before January 1, 1937; and that "air operated reverse gear (including thus power gears already installed) shall have a suitable steam connection" so arranged "that in case of air failure steam may be quickly used to operate the reverse gear."

The order of the commission was entered on a complaint of the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen. The complaint alleged, in substance, that while power reverse gear is a suitable, safe and practical device, manually operated reverse gear is inherently unsafe and unsuitable in principle and design; that it subjects employees and the traveling public to unnecessary peril; and that the use of locomotives equipped with hand reverse gears violates the boiler inspection act.

Practically all railroads of the United States were made respondents. They challenged in their answers the jurisdiction of the commission on the grounds that the procedure was unauthorized and that a power reverse gear was not a safety device or appliance within the meaning of the boiler inspection act; denied the essential allegations of the complaint; and, as additional reason for refusing its prayer, set up the impaired financial condition of the carriers.

Distribution of Material by Stores Department

CO-ORDINATOR Eastman announced on January 23 that the Association of American Railroads has approved and put into effect the following recommendation made by the federal co-ordinator:

"Delivery of material to point of use.

"It is recommended that the delivery of material and supplies to the point of use be organized and operated by the stores department unless it can be clearly dem-

(*Continued on next left-hand page*)

Total Funds Advanced by the Public Works Administration Under Railroad Contracts to December 31, 1934

Railroad	Date	Contract Amount	Purpose	Advances Amount
Baltimore & Ohio (3)	3/19/34	$4,500,000	Rail and equipment repairs	$4,340,000
	6/14/34	1,000,000	Construction of gondola cars	302,000
	6/14/34	900,000	Acquisition of passenger cars	—
Boston & Maine (4)	3/1/34	910,000*	Equipment repairs	910,000*
	3/13/34	2,230,000*	Rail	2,230,000*
	5/4/34	1,550,000*	Roadway repairs	1,550,000*
	6/26/34	2,628,000	New equipment	575,000
Central of Georgia	3/22/34	120,000*	Rail	109,000*
Chesapeake & Ohio	2/8/34	16,876,000	New equipment	15,938,000
Chicago & E. Ill.	2/2/34	240,000*	Rail	240,000*
Chicago & N. W.	1/31/34	1,400,000*	Rail	1,400,000*
Chicago Gr. W.	5/8/34	1,200,000*	New equipment	1,120,000*
C. M. St. P. & P. (2)	3/6/34	2,317,000*	Rail, air-conditioning, and auto-loader	2,317,000*
	3/31/34	1,716,000	Company-constructed equipment	1,537,000
Del. L. & W. (2)	4/19/34	3,623,000*	New equipment	3,619,000*
	5/9/34	1,043,000	Reconstructed equipment	434,000
Erie (2)	2/13/34	11,282,000	New equipment	10,686,000
	3/14/34	2,671,000	Rail and equipment repairs	2,560,000
Gr. Trunk Western	5/8/34	250,000*	Rail	250,000*
Great Northern (2)	4/2/34	4,935,000	Roadway and equipment repairs	4,240,000
	5/16/34	850,000*	Equipment repairs	850,000*
Gulf, M. & N. (4)	8/31/34	95,000*	New equipment	95,000*
	8/31/34	347,000*	New equipment	347,000*
	6/19/34	255,000*	Rail	255,000*
	8/30/34	350,000	New equipment	—
Illinois Central	12/12/34	12,000,000	New equipment, rail repairs and improvements	9,700,000
Interstate	4/5/34	250,000*	Rebuilt equipment	250,000*
Kan. Okla. & Gulf	2/20/34	255,000*	Rail	255,000*
Lehigh Valley (2)	1/20/34	2,000,000*	Equipment repairs	2,000,000*
	11/28/34	3,345,000	New and rebuilt equipment	759,000
Lehigh & N. E.	2/26/34	1,212,000*	New equipment	1,212,000*
Maine Central	4/9/34	313,000*	Rail	313,000*
Midland Continental	4/25/34	36,000*	New equipment	36,000*
Missouri Southern	8/15/34	32,500	New equipment	—
New York Central	4/25/34	2,500,000*	Rail	2,500,000*
N. Y. C. & St. L.	2/19/34	5,028,000	New equipment	4,809,000
N. Y. N. H. & H. (2)	4/11/34	4,800,000	Rail and equipment repairs	3,945,000
	4/17/34	2,300,000	New equipment	755,000
N. Y., O. & W.	3/28/34	235,000*	Rail	235,000*
Northern Pacific	2/13/34	1,220,000*	New equipment	1,220,000*
Pennsylvania (5)	11/1/34	37,000,000	Electrification	23,490,000
	11/1/34	8,550,000	New locomotives—outside shops	2,775,000
	11/1/34	14,450,000	New locomotives—company shops	3,293,000
	1/22/34	17,000,000	New freight cars	15,525,000
	2/9/34	3,650,000*	Rail	3,648,000*
Pittsburgh & W. Va.	3/8/34	331,000*	New equipment	331,000*
Southern Pacific	1/30/34	12,000,000*	Rail and equipment repairs	12,000,000*
Wabash	2/27/34	1,481,000	Rail and equipment repairs	1,295,000
TOTAL		$193,276,500		$146,250,000

*(Total Contracts completed $39,292,000)

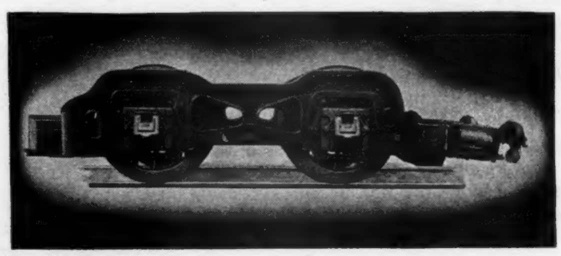
AIR CONDITIONING MAKES LUXURIOUS TRAINS!

THE LOCOMOTIVE BOOSTER MAKES COMFORTABLE TRAVEL!

Every effort towards more luxurious, more comfortable passenger travel is enhanced by utilization of The Locomotive Booster.

Along with the luxury that air conditioning brings, The Locomotive Booster provides added comfort in that it not only starts the train smoothly and without shock but also accelerates the train to road speeds more quickly.

The luxury of air conditioning needs extra power. On such trains The Booster is a necessity for comfortable travel as well as to meet the demand for higher speed.



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NEW YORK CHICAGO MONTREAL

onstrated that at some particular point conditions are so unusual as to make such procedure uneconomical."

This recommendation, Mr. Eastman said, was developed by the Section of Purchases of the co-ordinator's staff, in co-operation with the Purchases and Stores Division of the association. The subject had been studied for a number of years by a committee of the Purchases and Stores Division, and the information secured through this study indicated clearly that substantial saving would accrue to the railroads if material and supplies were kept under control of the stores department to the point of delivery to the using departments.

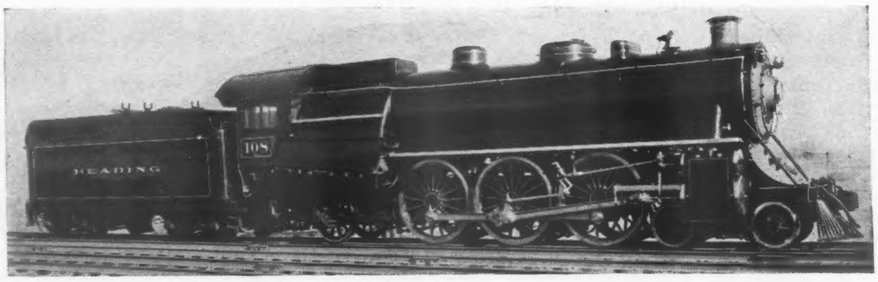
"Delivery by the stores department avoids divided control of equipment for handling materials, and prevents the waste due to using high-priced shop labor for handling operations and the consequent loss of time on shop operations. It enables stores officers to keep in closer touch with actual requirements, to reduce or eliminate unnecessary shop and line stocks, to maintain more effective control of stores stocks, and to locate and return to stores any materials requisitioned but not applied.

"Certain railroads which have already adopted this policy have shown savings of more than 60 per cent in the cost of delivering material to the using departments. A single large road reported savings of approximately $145,000. Other roads reported savings of more than $40,000 per year. Total annual savings reported by 13 roads were approximately $490,000."

Remodeled Reading Locomotive Makes Fast Run

A SPEED of "almost 100 miles an hour" was attained on January 11 during the test run on the Reading and Central of New Jersey of the remodeled steam locomotive which the Reading has recently completed, which was exhibited January 15 at the Jersey City, N. J., station of the C. N. J. The train with which the test was made between Philadelphia and Jersey City, consisted of four standard steel coaches and two Pullman cars. E. W. Scheer, vice-president in charge of operation and maintenance for the Reading and the Central of New Jersey, headed a party of the railroad's officials who made a 90-mile trip in 88 min., including three station stops.

The locomotive is of the 4-6-2 type, having an overall length, with tender, of 80 ft. 9¾ in. and a total weight, also including the tender, of 457,300 lb. The steam pressure is 220 lb.; cylinders, 25 in. by 28 in., and the tractive force, 40,900 lb. The locomotive has 80-in. driving wheels. In order to secure smooth exterior surfaces the air pump and main reservoir are mounted on the tender, the former in a compartment in front of the coal space on the right side, and the latter, with suitable radiation, on top of the tank, back of the coal space. The power reverse gear is mounted under the boiler in front of the leading driving axle. The casing on top of the boiler immediately behind the bell houses the boiler checks. The enclosure immediately in front of the cab, which is open at the top, conceals the turret, the safety valves, the whistle and the headlight turbo-generator. The shrouding below the firebox conceals the side of the ash pan and adds to the neatness of the lines. The headlight is concealed within the cone-shaped smoke-box door.



Makes "almost 100 miles an hour" on test run

Supply Trade Notes

THE HENNESSY LUBRICATOR COMPANY has reopened offices at 75 West Street, New York.

THE VAPOR CAR HEATING COMPANY, INC., Chicago, has discontinued its Boston, Mass., office. All matters in the Boston district are now handled through the New York office.

O. B. CAPPS, formerly eastern sales manager for the old Locomotive Stoker Company of Pitsburgh, Pa., is now representing The Standard Stoker Company, Inc., having his headquarters at its New York office at 350 Madison Avenue, but maintaining his residence at Oceana, Va.

THE STANDARD STEEL CAR CORPORATION, following its acquisition of the Pullman-Bradley Car Corporation, the Richmond Car Corporation, the Dickson Car Wheel Company and the New Orleans car Wheel Company, Inc., has been absorbed by the Pullman Car & Manufacturing Corporation, the name of the latter corporation being changed to the Pullman-Standard Car Manufacturing Company.

HENRY F. POPE, president of the National Malleable & Steel Castings Company, Cleveland, Ohio, has been elected chairman of the board, and Carl C. Gibbs, assistant to president has been elected president of the company. Mr. Pope had served as president of the company for 21 years. He entered the employ of the company on July 1, 1884, and had completed 50 years of service at the time of his election as chairman of the board. Mr. Gibbs began his employment with the company in 1905, as a salesman at its Indianapolis (Ind.) plant. In 1919 he was appointed sales manager of the Cleveland plant and the following year returned to Indianapolis as manager of the plant at that place. For the last five years Mr. Gibbs has been assistant to the president at Cleveland.

Henry F. Pope

Carl C. Gibbs

GEORGE McM. GODLEY of Greenwich, Conn., and New York City, has been elected president of the Burden Iron Company, Troy, New York, and O. A. Van Denbergh, Jr., of Troy, has been appointed vice-president and manager and has also been elected to the board. These elections fill the vacancies caused by the death of President William E. Millhouse last September. Mr. Godley is a graduate of the Massachusetts Institute of Technology, 1898, in the course of mining and metallurgical engineering. The following two years he studied metallography at the Freiberg Academy and University of Berlin, and subsequently went with the Midvale Steel & Ordnance Company, Philadelphia, Pa., helping to set up metallography laboratory. Mr. Godley was later connected with the New Jersey Zinc Company, the Warren Foundry & Machine Company, the Thomas Iron Company and from 1912 to 1920 was vice-president of

(*Continued on next left-hand page*)

the Linde Air Products Company. Following this he retired from active service and now becomes president of the Burden Iron Company, having been for a number of years a member of its board.

George McM. Godley

Mr. Van Denburgh is a graduate of the Rensselaer Polytechnic Institute, 1913, with the degree of mechanical engineer. He served with the Cambria Steel Company, Johnstown, Pa., until 1917, when he entered the Ordnance Department of the United States Army. He was later transferred to the Chemical Warfare Service, serving until 1919. At the close of the war he returned to the Cambria Steel Company, and subsequently was in the employ of the Aluminum Company of America at Pittsburgh, Pa., then for two and one-half years with the United States Navy as mechanical engineer in the Bureau of Engineers. In 1923 he became works

O. A. Van Denburgh, Jr.

engineer of the Burden Iron Company and later assistant manager.

Carlton D. Stewart has been appointed chief engineer of the Westinghouse Air Brake Company, with headquarters at Wilmerding, Pa., and John B. Hull, to district engineer, with headquarters at San Francisco, Cal.

After his graduation from the Blairsville, Pa., high school in 1905, Mr. Stewart entered the employ of the Westinghouse Company as machinist apprentice. Before completing this training he enrolled in the mechanical engineering course at Pennsylvania State College, returning to the Westinghouse Company in 1912 as a special engineer. He was sent to the San Francisco, Cal., office as mechanical expert in 1913 and three years later took on the additional duties of shop superintendent of the Pacific Coast Brake Company, a subsidiary. In 1917, Mr. Stewart was promoted to the position of district engineer of the Westinghouse Air Brake Company,

Carlton D. Stewart

and in 1925 was elected vice-president, director and manager of the above-mentioned subsidiary, in which positions he served until his appointment as chief engineer.

Mr. Hull was born in Connecticut and attended schools in that state; he later entered the Sheffield Scientific School of Yale University, but during the World

John B. Hull

War he served with the U. S. Army in France. After the Armistice he returned to Yale, finished his college course, and in 1920 entered the employ of the Westinghouse Air Brake Company at Wilmerding, Pa., as special engineer. In 1925 he served as assistant chief draftsman, and two years later as assistant to the chief design engineer. From 1929 until his appointment as district engineer Mr. Hull had been assistant district engineer at San Francisco.

Griswold Price, assistant manager of sales of the St. Louis district of the Illinois Steel Company, the Carnegie Steel Company, and the Tennessee Coal, Iron & Railroad Company, has been appointed manager of sales for these companies, with the same headquarters. Mr. Price graduated from Northwestern University in 1919 and entered the employ of the Illinois Steel Company in July of that year. After

Griswold Price

spending one year at the Gary, Ind., and South Chicago plants of this company, he was employed in the Chicago district sales office and general sales department from July, 1920 to June 1, 1931. On the latter date he was appointed assistant manager of sales of the St. Louis district.

William E. Corrigan, district sales manager of the American Locomotive Company, at Cleveland, Ohio, has been appointed assistant vice-president, Railway Steel-Spring division of the American Locomotive Company, with headquarters at New York, reporting to Alexander S. Henry, vice-president, Railway Steel-Spring division. Hunter Michaels succeeds Mr. Corrigan as district sales manager of the American Locomotive Company at Cleveland. Mr. Corrigan will have charge of sales of springs, tires and appurtenant parts. He entered the service of the American Locomotive Company in 1909, and is a graduate of the four-year course in locomotive construction conducted in the engineering department of

William E. Corrigan

the company at Schenectady, N. Y. He served in various capacities in the drawing office at Schenectady from May, 1913, until 1915, when he was transferred to the Cooke plant, Paterson, N. J. He was employed on elevation work and general cal-

(*Continued on next left-hand page*)

culating at Paterson until November, 1917, when he entered the United States Army, serving successively as second lieutenant, first lieutenant and captain in the artillery ordnance branch, field service, in charge of plant production at several gun carriage and ammunition plants. After the armistice, he became secretary and then ordnance district chief and chairman of the claims board in charge of the settlement of claims arising out of the cancellation of war contracts between the government and various manufacturers. Mr. Corrigan re-entered the employ of the American Locomotive Company in 1920, serving for two years in the sales department at New York, when he was transferred to Chicago as salesman for Alco accessories in the middle western territory. In 1923 he was appointed general sales representative of the company on the Pacific Coast with the title of district sales manager, and in 1930 was transferred to Cleveland.

CARL S. CLINGMAN, Transportation department sales manager of the Western region, of Johns-Manville Sales Corporation, with headquarters at Chicago, has been appointed general sales manager of the Transportation department. Mr. Clingman was educated in mechanical engineering at Northwestern University, 1904. He began work with the Pullman Company in its apprentice school and in 1907 became assistant general shop foreman at the Pullman, Ill., works. The following year he was transferred to Wilmington, Del., as eastern mechanical inspector. In 1910 he returned to the Pullman Ill. works as mechanical inspector, and the following year was appointed general mechanical inspector at Chicago. He entered the service of Johns-Manville in 1917, as sales representative in the southwest, and for the past year had been serving as Transportation department sales manager of the western region. Mr. Clingman will continue to have direct responsibility for the western region.

Carl S. Clingman

W. MORGAN HOOD, sales representative of The Lunkenheimer Company, Cincinnati, Ohio, died at Roanoke, Va., on January 9 as the result of an automobile accident. Mr. Hood was well-known throughout the southeastern states, having traveled that territory for the Lunkenheimer Company for more than 20 years. He was 67 years old and had his headquarters at Washington, D. C.

ALBA BOARDMAN JOHNSON, president of the Baldwin Locomotive Works from 1911 until 1919, died of a heart ailment at his home in Rosemont, Pa., on January 8. Mr. Johnson was born at Pittsburgh on February 8, 1858, and was graduated from Central High School, Philadelphia, in 1876 with a B.A. degree. Later he was awarded LL.D. degrees from Ursinus College (1909) and from the University of Vermont (1928). He began his business career in 1877 as a junior clerk with Burnham, Parry, Williams & Co. (now Baldwin Locomotive Works) at Philadelphia. During 1878-1879 he was employed as a stenographer by the Edgemoor Iron Works, Wilmington, Del., returning in 1879 to Burnham, Parry, Williams & Co. where he continued in stenographic positions until 1896. In the latter year Mr. Johnson became a partner in the firm and continued as such until 1909 when Burnham, Parry, Williams & Co. was incorporated into the Baldwin Locomotive Works. With the incorporated company he was vice-president and treasurer during 1909-1911 and president from 1911 until his retirement in 1919. Meanwhile, in 1918, Mr. Johnson had been elected president of the R.B.A., a position which he retained for 13 years after his retirement from the Baldwin presidency or until April, 1932, when he was succeeded by Harry A. Wheeler. Mr. Johnson had at various times during his career been president of Jefferson Medical College, Philadelphia, president of the Pennsylvania State Chamber of Commerce and a director of the Federal Reserve Bank.

Alba B. Johnson

Personal Mention

General

W. WALKER, acting superintendent of motive power and car equipment of the Canadian National, at Edmonton, Alta., has been appointed superintendent of motive power and car equipment.

J. L. CARVER, engineer of tests of the Illinois Central, with headquarters at Paducah, Ky., has been promoted to mechanical engineer, with headquarters at Chicago, succeeding William O. Moody, deceased. Mr. Carver was born on December 10, 1891, at West Medford, Mass. He is a graduate of the Armour Institute of Technology at Chicago, Class of 1914. He entered the service of the Illinois Central on October 1, 1914, as a clerk in the car department at Chicago. From March 9, 1915, until September 1, 1916, he was a chemist and material inspector in the test department and on the latter date became assistant chief chemist. On December 10, 1917, he left the service to join the United States Army. He served in the ordnance branch until January 1, 1919, when he returned to the Illinois Central as assistant chief chemist. A month later he was appointed engineer of tests.

J. L. Carver

Shop and Enginehouse

CLARENCE REYNOLDS, department foreman of heavy boiler repairs of the Louisville & Nashville at South Louisville, Ky., has been promoted to the position of general foreman, boiler department.

Purchasing and Stores

T. A. STINSON, storekeeper of the Green Bay & Western at Green Bay, Wis., has had his title changed to general storekeeper.

Obituary

G. G. DAVIS, who retired as superintendent of the shops of the Cleveland, Cincinnati, Chicago & St. Louis at Beech Grove, Ind., in 1925, died in Florida on January 14 at the age of 80.

WILLIAM O. MOODY, mechanical engineer of the Illinois Central, who died on December 25, was born in 1871, at Chicago. He first entered railway service in 1890 as a machinist apprentice on the Illinois Central. From 1893 to 1896, he was out of railway service, returning to the Illinois Central at the end of this period as chief draftsman. During 1903 and 1904, Mr. Moody served as a foreman in the car department on the construction of steel passenger cars, then returning to the position of chief draftsman. In 1906, he was appointed mechanical engineer with headquarters at Chicago.